

Missouri Well Construction Rules

Private Water Wells,

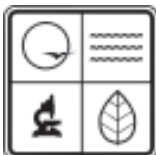
Heat Pump Systems,

Pump Installations

and

Monitoring Wells

Authorizing Statutes—256.600 to 256.640 RSMo



**Missouri Department of Natural Resources
Division of Environmental Quality
August 2009**

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PREAMBLE

The purpose of the Water Well Drillers Act, section 256.600 to 256.640 RSMo, and the regulations written to enforce this statute, is to establish standards that will protect Missouri's groundwater. The quality of groundwater in Missouri varies considerably across the state. Some areas have abundant, high quality groundwater while wells in other areas have natural highly mineralized or muddy water. In some areas of Missouri, pre-existing land use and other practices, such as waste disposal, have contaminated the aquifer. Because of the variability of groundwater quality in Missouri, these regulations can not guarantee that water produced from a properly constructed well will be of usable quality. The well construction regulations are designed to ensure that contamination from the surface is not entering the subsurface from an improperly constructed well. These regulations establish minimum specifications for well construction. In certain cases, more casing and grout may be necessary. Experienced permitted drillers and pump installers should be able to determine when more stringent construction will be necessary.

This copy of the *Missouri Well Construction Rules* that govern the drillers and well construction of private water wells, ground source heat pump systems, pump installations and monitoring wells has been reprinted for use by the Wellhead Protection Section, Division of Environmental Quality. Official copies of the Code of State Regulations are available through the Secretary of State's office.

Missouri Well Construction Rules

Private water wells, heat pump systems, pump installations and monitoring wells

August 2009



MISSOURI DEPARTMENT OF NATURAL RESOURCES
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Chapter 1

Definitions and Organizational Structure

TITLE 10 - DEPARTMENT OF NATURAL RESOURCES
Division 23 - Division of Geology and Land Survey

Chapter 1 - Definitions and Organizational Structure

10 CSR 23-1.010 Definitions

PURPOSE: This rule defines the words used in the text of the rules promulgated to implement the Water Well Drillers Law.

(1) **Abandoned well**, as defined in section 256.603, RSMo, means a well shall be deemed abandoned when it is in such a state of disrepair that continued use for the purpose of thermal recovery or obtaining groundwater is impractical and the well has not been in use for a period of two years or more. The term abandoned well includes a test hole or a monitoring well which was drilled in the exploration for minerals or for geological, water quality or hydrologic data from the time that it is no longer used for exploratory purposes and that has not been plugged in accordance with rules pursuant to sections 256.600-256.640, RSMo.

(2) **Act** means Missouri Water Well Drillers Law, sections 256.600-256.640, RSMo, under which these rules are promulgated.

(3) **Annular space** means the space between two cylindrical objects one of which surrounds the other, such as the space between a drillhole and a casing pipe, or between a casing pipe and liner pipe.

(4) **Applicant** means any person who applies for a well, heat pump, monitoring well or pump installation contractor permit pursuant to the law.

(5) **Application for permit** means the application submitted by an applicant.

(6) **Aquifer** means water-bearing geological material that transmits water in sufficient quantities to supply a well.

(7) **Bedrock** means competent rock that is not weathered or fractured.

(8) **Bentonite** means any type of sodium bentonitic clay used in well construction, or plugging of wells, which swells or expands when water is added.

(9) **Board**, as defined in section 256.603, RSMo means the body created in section 256.605, RSMo.

(10) **Casing** means an impervious durable pipe placed in a well to prevent the walls from caving and to help seal off surface drainage or undesirable water, gas or other fluids to prevent their entering the well.

(11) **Casing point request form** means a form that is supplied by the division and contains name and address information, type of well requested to be drilled, location information and other necessary information. The division uses the form to establish construction requirements, proposed total depth of well and proposed yield information for specific types of wells.

(12) **Certification** report as defined in section 256.603, RSMo means a form to be sent to the division upon completion of any well which shows the location, static water level, total depth, initial pumpage, hole size, casing size and length and name of well owner.

(13) **Cesspool** means an underground pit or container into which raw household sewage or other untreated liquid waste is discharged and from which the liquid seeps into the surrounding soil or is otherwise removed.

(14) **Chlorination** (disinfection) means the use of a chlorine solution to disinfect or sterilize wells, pumps, storage tanks or piping systems. Chlorine is an oxidizing disinfectant that kills bacteria on contact.

(15) **Completion date** means the date that the construction of a new well or repair of an existing well or the installation of a pump or the plugging of an abandoned well is completed. It shall not mean the date that payment is received for services provided.

(16) **Construction foundation data** means wells drilled to obtain construction foundation data and wells drilled in the construction phase of piers, shafts, caissons, mini-piles, soil and rock anchors, soil and rock grouting procedures on surface water containment structures and other construction sites that utilize drilling within the structure to be built. The well or drill hole must be excavated and incorporated into the construction project or plugged full-length as a part of the construction project.

(17) **Cuttings** mean geologic material displaced from the drill hole during drilling.

(18) **Director** means the director of the Division of Geology and Land Survey, or authorized representatives, who shall carry out the administrative functions of these rules on behalf of the division.

(19) **Division**, as defined in section 256.603, RSMo, means the Division of Geology and Land Survey.

(20) **Driller's log**, as defined in section 256.603, RSMo, means a record accurately kept at the time of drilling showing the depth, thickness, character of the different strata penetrated, location of water-bearing strata, depth, size and character of casing installed, together with any other data or information required on the certification report forms.

(21) **Drive shoe** means the fitting placed at the bottom of the permanent metal casing, which enables the driller to more efficiently drive the casing into solid rock.

(22) **Established ground surface** means the actual finished grade of the surface of the ground at the site of the well.

(23) **Examination**, as defined in section 256.603, RSMo, means an assessment of professional competency administered to applicants.

(24) **Geological material** means all materials penetrated in drilling a well.

(A) **Alluvium** is a general term for clay, silt, sand, gravel or similar unconsolidated material deposited during comparative recent geologic time by a stream or body of running water as a sorted or semi-sorted sedimentary deposit.

(B) **Dolomite** means rock which contains at least 50 percent or more magnesium carbonate and has a weak reaction with a 10 percent hydrochloric acid (HCL) solution.

(C) **Glacial drift** (unconsolidated) means a general term applied to all rock material (clay, sand, gravel and boulders) transported by a glacier and deposited directly by or from the ice or by running water emanating from the glacier.

(D) **Glacial outwash** means a stratified sand and gravel removed or washed out from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or the margin of an active glacier.

(E) **Limestone** means rock which contains 50 percent or more calcium carbonate and has a strong reaction with a 10 percent hydrochloric acid (HCL) solution.

(F) **Residuum** means a product formed from the in-place disintegration and decomposition of bedrock.

(G) **Sandstone** means cemented or otherwise compacted sediment composed predominantly of sand.

(H) **Shale** means a laminated rock consisting predominantly of clay-sized particles.

(25) **Grout** means cement-slurry, 16 lbs/gal density - one bag Type I cement to six gallons water mix, Type II - V cement mix to manufacturers specifications, high solids 20 percent or more solids bentonite slurry, sodium bentonite chips or pellets or any other commercially available grout approved by the division.

(26) **Heat exchange or heat pump well** means any well constructed to use the heat exchange properties of either groundwater or of geologic material penetrated in the well.

(27) **Heat pump installation contractor**, as defined in section 256.603, RSMo, means any person, including owner, operator or drilling supervisor who engages for compensation in the drilling, boring, coring or construction of any well in the state for extracting thermal energy.

(28) **Lakes** are defined as the major reservoirs in Missouri. They are considered a sensitive area under these rules. They include: Clearwater Lake, Lake of the Ozarks, Stockton Lake, Pomme de Terre Lake, Bull Shoals Lake, Norfolk Lake, Table Rock Lake, Lake Wappapello and Truman Reservoir (see map following 10 CSR 23-6).

(29) **Liner** means plastic or steel pipe which is smaller in diameter than the casing and used to solve problems encountered in deeper geologic formations or to reconstruct a well.

(30) **Major reconstruction** means the alteration or repair of any well that changes the original specifications or casing depths or total depth of the well; for example: liners, packers or deepening of well or extension of casing above finished grade.

(31) **Monitoring well installation contractor**, as defined in section 256.603, RSMo, means any person, including owner, operator or drilling supervisor who engages for compensation in the drilling, boring, coring or construction of any well in this state which is drilled for geologic data, water quality or hydrologic data.

(32) **Packer** in these rules means a rubber or neoprene collar (boot) installed on casing or liner to hold the grout material in the annular space and to help affect a seal of the casing.

(33) **Permitted well driller**, as defined in section 256.603, RSMo, means any person who holds a permit issued pursuant to the provisions of sections 256.600-256.640, RSMo.

(34) **Permittee** means a person who is permitted as a well, heat pump, monitoring well or pump installation contractor pursuant to the provision of the law and these rules.

(35) **Person**, as defined in section 256.603, RSMo, means any individual, whether or not connected with a firm, partnership, association, corporation or any other group or combination acting as a unit.

(36) **Pitless adapter** means a device for above or below ground discharge designed for attachment to one or more openings through a well casing and constructed so as to prevent the entrance of contaminants into the well.

(37) **Pitless unit** means an assembly with cap which extends from the upper end of the well casing to above grade and is constructed so as to prevent the entrance of contaminants into the well.

(38) **Plastic** means a thermoplastic pipe or casing material composed of either polyvinyl chloride (PVC) or acrylonitrile-butadiene-styrene (ABS).

(39) **Point of entry** means the point when the main water supply line hooks up to the central plumbing in a building.

(40) **Potable water** means water which is safe for human consumption in that it is free from impurities in amounts sufficient to cause disease or harmful physiological effects.

(41) **Pressure grout** refers to the process of applying grout material under pressure to the annular space of a well for the purpose of sealing it and thus preventing vertical movement of fluids through the annular space. Grout must be introduced from the bottom of the annular space.

(42) **Pressure tank** or hydropneumatic tank means a closed water storage container constructed to operate under a designed pressure rating to modulate the water system pressure within a selected pressure range.

(43) **Priming** means the first filling of a pump with water and action of starting the flow in a pump.

(44) **Pump installation contractor**, as defined in section 256.603, RSMo, means any person, firm or corporation engaged in the business of installing or repairing pumps and pumping equipment.

(45) **Pump installation machine or service rig** means any vehicle, hoist or machine used to install or remove pumps or liners from wells.

(46) **Pumps and pumping equipment** means materials used or intended for use in withdrawing or obtaining groundwater for any use, except as applies to sampling, development, maintenance or testing equipment used or inserted into monitoring wells including, without limitation, seals and other safeguards to protect the water from pollution and together with plumbing fittings, electric wiring and accessories, and controls provide sanitary water storage facilities. Installation of pumps and pumping equipment means the selection of and the procedure employed in the placement and preparation for operation of pumps and pumping equipment. This includes the construction involved in making entrance to the well and into the building served, water distribution lines from the well through the pressure tank and water treatment equipment, to the main point of entry and establishing proper seals and other safeguards to protect groundwater from pollution, including repairs to existing installations.

(47) **Registration report**, as defined in section 256.603, RSMo, means a form to be sent to the division upon completion of plugging of an abandoned well, raising casings, lining wells, deepening of wells, major repairs and alterations and jetted wells.

(48) **Scope**. For the purposes of these rules promulgated pursuant to Missouri Water Well Drillers Act, section 256.600, RSMo, the terms defined in this part have the meanings given them, except where the context clearly indicates otherwise.

(49) **Screen** means a filtering device used to keep sediment from entering a well.

(50) **Septic tank** means a watertight tank of durable materials through which sewage flows very slowly and in which solids separate from liquid to be decomposed or broken down by bacterial action.

(51) **Service connection** means a supply line from the well that is connected to one single family dwelling or in a farming application it shall include all additional water hookups for the out buildings. If the out buildings are dwellings for persons or additional businesses then they would be considered additional service connections.

(52) **Sewage** means the water carried waste products from residences, public buildings, including the excrementitious or other discharges from the bodies of human beings or animals.

(53) **Sewer** means a pipe or conduit carrying sewage or into which sewage may back up.

(54) **Site** means a plot of land on which wells are drilled or are going to be drilled that is not more than 40 acres and is owned by a person as defined in section 256.603, RSMo. If larger sites exist contact the division for reporting requirements.

(55) **Static water level** means the distance measured from the established ground surface to the water surface in a well neither being pumped, nor under the influence of pumping nor flowing under artesian pressure.

(56) **Subsurface disposal field, seepage bed, drainfield, percolation system or tile absorption field** means a system composed of open jointed tile, plastic lines or lines composed of other material buried in stones and shallow trenches or beds through which septic tank effluent is disposed. The septic tank effluent is applied to land by distribution beneath the surface through the open jointed lines.

(57) **Suction line** means a pipe or line connected to the inlet side of a pump or pumping equipment or any connection to a well casing that may conduct nonsystem water into the well because of negative pressures.

(58) **Tremie pipe** means a small diameter conductor pipe, hose or tubing used in the down hole placement of well construction material.

(59) **Upper termination of the well casing** means a point 12-inches or greater above the finished ground surface.

(60) **Variance** means any modification to the application of these rules. A variance may be applied for through the procedure set out in 10 CSR 23-1.040 of these rules.

(61) **Water varieties** mean

(A) **Groundwater** means the water in the subsurface zone of saturation. The water that supplies springs and wells is groundwater; and

(B) **Surface water** means water that rests or flows on the surface of the ground.

(62) **Well**, as defined in the section 256.603, RSMo, means an excavation that is drilled, cored, bored, washed, driven, dug, jetted, trenched or otherwise constructed when the intended use of the excavation is for the acquisition of groundwater supply, for monitoring, thermal exchange or for exploration for minerals or geologic or hydrologic data; but does not include a cistern, an excavation made for the purpose of obtaining or for prospecting for oil or natural gas, or for construction foundation data, dewatering of construction sites or dewatering of existing structures, observation wells used as a part of an underground storage tank leak detection system of a minimal depth, as determined by the board by rule, or for inserting media to repressure oil or natural gas-bearing formations.

(63) **Well certification** means the well certification report form and certification fee have been submitted to the division, the form has been reviewed by the division to verify the well has been constructed in accordance with the rules, and the division has assigned a well certification number to the well. The well certification number will be sent to the well owner by the division.

(64) **Well drilling machine or service rig** means any machine or device such as a cable tool, rotary, hollow rod auger, and the like used for construction of wells or a hoist, machine or vehicle used in well service that involves the modification to the well casing, screen depth or diameter below the upper termination of the well casing or pump installation or repair. This excludes trenching machines in heat pump applications.

(65) **Well installation contractor**, as defined in section 256.603, RSMo, means any person, including owner, operator, and drilling supervisor who engages for compensation in the drilling, boring, coring or construction of any well in this state. The term, however, shall not include any person who drills, bores, cores, or constructs a water well on his/her own property for his or her own use or a person who assists in the construction of a water well under the direct supervision of a permitted well installation contractor and is not primarily responsible for drilling operations.

(66) **Well owner**, as defined in section 256.603, RSMo, means any person or corporation who is the party responsible for having a well drilled and whose name appears on the well registration or certification form.

(67) **Well registration** means the registration report form and registration fee have been submitted to the division, the form has been reviewed by the division which documents certain types of activities according to the requirements. If the documented activities meet the requirements then a registration number is assigned by the division and sent to the well owner.

(68) **Well seal** means a device or method used to protect a well casing or water system from the entrance of any external pollutant at the point of entrance into the casing.

(69) **Well vent** means an outlet at the upper terminal of a well casing to allow equalization of air pressure in the well and escape of toxic or flammable gasses when present.

(70) **Yield or production** means the quantity of water per unit of time that may flow or be pumped from a well under specified conditions.

Auth: sections 256.603 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority 1985, amended 1991.*

10 CSR 23-1.020 Application to All Wells

PURPOSE: This rule explains the application of the law to the wells in the state.

10 CSR 23 Chapters 1-6 shall apply to all wells in Missouri except those specifically exempted by the act. Those aspects covered are the construction on new wells, installation of pumps and pumping equipment, the repair and maintenance of wells and pumps and pumping equipment where specified, the proper plugging of wells, and the proper isolation of possible sources of contamination from existing wells to protect the quality of groundwater aquifers for providing safe drinking water supplies.

Auth: section 256.615, 256.620 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.615, RSMo (1991) and 256.620 and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.030 Types of Wells

PURPOSE: This rule describes the types of wells covered by the law.

(1) **Public Water System.** A system for the provision to the public of piped water for human consumption, if this system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. This system includes any collection, treatment, storage or distribution facilities used in connection with the system. A public water system is a community water system, transient noncommunity water system or nontransient noncommunity water system. Any community or noncommunity public water supply well must be constructed according to Missouri Public Drinking Water Branch Rules.

(A) **Community Water System.** A public water system which serves at least 15 service connections or regularly serves an average of at least 25 residents on a year-round basis.

(B) **Transient Noncommunity Water System.** A public water system that is not a community water system which has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year.

(C) **Nontransient Noncommunity Water System.** A public water system that is not a community water system, and that regularly serves at least 25 of the same persons over six months per year.

(2) **Petroleum Distribution Site Well.** A water supply well constructed adjacent to and in connection with petroleum distribution sites is considered a noncommunity water supply.

(3) **Multiple Family Well.** A private water supply well constructed for the purpose of serving more than three dwellings, but having less than 15 service connections and serving less than 25 individuals daily at least 60 days out of the year.

(4) **High Yield Well.** Those water supply wells that are constructed to meet required standards and are equipped with a pump that has the capacity to produce more than 70 gallons of water per minute (see 10 CSR 23-3.030 for construction requirements).

(5) **Domestic Well.** A private water supply well that is constructed to meet minimum standards and is equipped with a pump that does not have the capacity to produce more than 70 gallons of water per minute and services three or less service connections. A private domestic water supply well that produces less than 70 gallons of water per minute regardless of the use is a domestic well.

(6) **Grade A Dairy Well.** Water supply well installed to service and supply Grade A dairy operations and is constructed to domestic well standards.

(7) **Unconsolidated Material Irrigation Well.** Water supply well drilled into alluvial, glacial drift or glacial outwash aquifers and is not deeper than two hundred feet (200'), and produces water not for human consumption and is equipped with a pump that has the capacity to produce more than 70 gallons of water per minute (see 10 CSR 23-3.030 for construction requirements).

(8) **Bedrock Irrigation Well.** Water supply well drilled into bedrock aquifers that is constructed to meet required standards and is equipped with a pump that has the capacity to produce more than 70 gallons of water per minute. The produced water is for irrigating crops but may be used for human consumption (see 10 CSR 23-3.030 for construction requirements).

Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.040 Modification by the Division

PURPOSE: This rule explains how the division may make modifications to the application of the provisions of the rules.

(1) When strict applicability of any provision of these rules presents practical difficulties or unusual hardships, the division, in a specific instance, may modify the application of those provisions consistent with the general purpose of these rules and the law. The division may then impose certain conditions as are necessary, in the opinion of the division, to protect the groundwater of the state and health, safety and general well-being of persons using or potential users of the groundwater supply.

(2) Any request for modification shall be submitted in advance to the division in writing on a variance form obtained from the division and shall be signed by the permittee. This request shall specify in detail the nature of the modification being sought, the reasons and the special precautions to be taken to avoid contamination of the well. The request shall also include the proposed well depth, casing type and depth, method of construction and grouting, geological conditions likely to be encountered and location of the well and possible sources of contamination. Whether or not the requests are granted, the division shall state in detail the reasons for the decision. If the requested modification is approved, the division will send or fax the requestor a copy of the approved variance form. The approved variance form must be received by the permittee before construction or modification of the well begins. The approved variance form must be attached to the well certification or registration form when it is submitted to the division.

(3) A modification request may be initiated by telephone if there are extenuating circumstances associated with a particular well. This request shall be followed by the proper notification procedures as stated previously.

Auth: section 256.606 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.050 Qualifications

PURPOSE: This rule establishes the criteria and procedures used in permitting a well installation, heat pump installation, monitoring well installation, pump installation, employee or drilling supervisor contractor in Missouri.

(1) All applicants for a non-restricted well installation, heat pump installation, monitoring well installation, monitoring test-hole installation, and pump installation contractor permits shall meet the following requirements:

(A) Applicant must submit the testing application, supplied by the division, and appropriate testing fee;

(B) Applicant must pass the general test (open-book) with a minimum score of seventy percent (70%);

(C) After passing the general test, applicant must submit an apprenticeship application, supplied by the division. The apprenticeship application must be accompanied by the appropriate permit fee, and must be signed by the non-restricted permittee who will be responsible for the apprenticeship and apprentice's work;

(D) After approval of the application for apprenticeship, the division will issue the applicant a permit number for use during the apprenticeship;

(E) Applicant must be an apprentice for a period of two (2) years;

(F) During the two (2) year apprenticeship the apprentice must perform the type of work applying for and sign and submit the appropriate certification or registration form on at least:

1. Twenty-five (25) different water well installations;

2. Twenty-five (25) different pump installations;

3. Ten (10) different heat pump installations; and/or

4. Twenty (20) different monitoring well sites;

(G) Applications submitted from work performed by an apprentice in other states will be considered as long as the corresponding state has construction requirements similar to the requirements of the State of Missouri;

(H) The non-restricted permittee responsible for the apprentice must also sign the required certification/registration form as the installation contractor and submit the form and appropriate fee to the division;

(I) At the end of the two (2) year apprenticeship; the apprentice must submit a testing application and the appropriate testing fee for the specific (closed-book) test;

(J) If, at the end of the two (2) year period, the apprentice has not completed the required number of installations, the apprentice may apply to extend the apprenticeship on a year by year basis; and,

(K) After completion of the apprenticeship period and passing the specific test, the apprentice must submit a contractor application, supplied by the division, with appropriate fees. After approval of the application, the division will issue the apprentice a non-restricted permit.

(2) The apprentice may transfer to another company; however, a non-restricted permittee must sign as the responsible party for the apprentice. The apprentice may apply to transfer to another company by submitting a new apprenticeship application to the division.

(3) Applicants for the non-restricted permit who hold a valid permit that is in good standing in another state with requirements similar to the State of Missouri's requirements, as determined by the division, who is currently permitted with the State of Missouri, must submit the testing application, appropriate testing fee, and proof of the valid permit to be scheduled for the test. After passing the general (open-book) and specific (closed-book) tests with a minimum score of seventy percent (70%) on each test, the applicant must submit each of the following to the Division within thirty (30) days:

(A) A contractor application;

(B) Vehicle application, supplied by the division, for each drilling rig, pump truck or service rig which will be used by the permittee and appropriate fee;

(C) Proof of financial responsibility in the form of a surety bond, certificate of deposit (CD), or irrevocable letter of credit in the amount of twenty-five thousand dollars (\$25,000). The bond, CD, or letter of credit shall be:

(1) Placed on file with the division;

(2) Made payable to the Department of Natural Resources; and,

(3) Issued by an institution authorized to issue such bonds in this state.

(4) Certificate of deposit must be automatically renewable for timeframe covering the apprenticeship; and,

(5) Any interest on the certificates of deposit shall be made payable to the permittee.

(D) The requirement for proof of financial responsibility shall cease after two (2) consecutive years of permitted activity if the contractor does not have any outstanding notices of violation against their permit. If the contractor does not have any outstanding violations at the end of the two (2) year period, the bond or letter of credit will be returned to the contractor within thirty (30) days of the end of the two (2) year period;

(E) If at the end of those two (2) years the division has found that the contractor has failed to meet the construction standards set forth in the Missouri Well Construction Rules, the division shall notify the contractor, within sixty (60) days, that the bond or letter of credit will be forfeited and the moneys placed in the Groundwater Protection Fund for remedial action, if the permittee does not bring the well up to the standards established in the notice of violation within the timeframes determined by the division. The division may, upon expiration of the notification period, expend whatever portion of the bond or letter of credit is necessary to hire another contractor to bring the well or borehole up to the standards set forth in the notice of violation or to plug the well and construct a new well; or,

(F) If at the end of those two (2) years the division has found that the contractor has outstanding violations against the administrative standards set forth in the

Missouri Well Construction Rules, the division shall notify the contractor, within sixty (60) days that the bond or letter of credit will continue to be held as a condition of permit renewal for period of another two (2) years.

(G) If apprentice cancels the apprenticeship, he/she may reapply, within one (1) year of termination. If the application is approved, apprentice will be reinstated at the same status as at the point of termination.

(4) A special restricted permit and examination are available, upon request, for those persons who only drill unconsolidated material wells or set pumps in them. To be scheduled for this type of restricted examination, an application must be received at least fifteen (15) days prior to the testing date for which the applicant wishes to be scheduled. If a restricted permittee is found to be drilling or setting a pump in a type of material they are not permitted to operate in, they will be subject to appropriate enforcement action.

(5) Information on where to obtain applicable study material will be available to each applicant prior to testing;

(6) A testing schedule will be available upon request of the applicant;

(7) A completed application for testing must be received fifteen (15) days prior to the testing date for which the applicant wishes to be scheduled. The division will notify the applicant within ten (10) days from receiving the completed application for testing if the applicant has qualified to take the test applied for and the date of the next available test. The testing fee is due before the test is given;

(8) A minimum score of seventy percent (70%) on the general test, and a minimum score of seventy percent (70%) on each required specific test must be achieved by the applicant prior to being permitted. The applicant will be sent the results of the test as soon as possible. If applicant has a passing score, the appropriate applications for permit will be included with the results;

(9) Applicant may retake all tests on the same day if time allows. All retakes must be accompanied by the testing fee;

(10) If a request is made and documented more than thirty (30) days in advance, the exam may be taken orally. The same exam will be given and the same results must be achieved on an oral exam as for a written exam. Due to

the special nature of this type of exam, special scheduling dates will be necessary. People with disabilities requiring services or accommodations can make arrangements by contacting the division;

(11) Any applicant who does not agree with his/her test results, may appeal to the Well Installation Board;

(12) If an applicant wishes to withdraw his/her application for testing, s/he may do so by requesting, in writing, ten (10) days in advance. If the applicant does not cancel as stated and is not present for the test, they may reschedule up to two (2) times. If after the second reschedule the applicant does not appear, the testing application will be cancelled and the fee will be forfeited. If the applicant wishes to take the test after the testing application has been cancelled, they must reapply and submit the appropriate fee;

(13) Persons who contract the drilling of wells, installation of pumps, or both, but do not drill the wells or set the pumps must be a permitted well installation, heat pump installation, monitoring well installation, monitoring-test hole installation, or pump installation contractor, or any combination of these. The only test required is the general (open-book) test. A restriction must be placed on the permit which states that any well drilling or pump work contracted be done by a nonrestricted permitted installation contractor. Persons who wish to apply for this type of exam shall submit the testing application and appropriate fees;

(14) A nonrestricted permitted well installation, heat pump installation, monitoring well installation, monitoring-test hole installation, pump installation contractor, or any combination of these, must be present at all times during the apprentice's initial number of installations (see 1(F) of this rule). The nonrestricted permittee must be on site during the initial installations (see 1(F) of this rule) while a well is being drilled and completed, a pump is being set, or any combination of these; and

(15) Persons who wish only to drill the heat pump hole and grout the closed-loop into the heat pump hole must obtain a permit to do so. The permit will be restricted to the previously mentioned activities and a current nonrestricted water well installation contractor's permit is required as one of the qualification criteria. Those people who wish to apply for this type of heat pump installation contractor's permit that have a valid nonrestricted water well installation contractor permit must only take the general test covering heat pump construction.

(16) Applicants for contractor permits who do not meet the requirements set out in this rule may petition the board. The board has the authority to rule upon the qualifications of the applicants and may require additional evidence of qualifications.

*AUTHORITY: sections 256.606, 256.607, 256.611, 256.613 and 256.626, RSMo (1994).
* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed December 3, 2008, effective March 1, 2009.
Original authority: 256.606, RSMo (1991); 256.607, RSMo (1985), amended 1991; 256.611, RSMo (1985), amended 1991; 256.613, RSMo (1991); and 256.626, RSMo (1985), amended 1991.

10 CSR 23-1.060 Application for a Permit

PURPOSE: This rule outlines the division's requirements for filing an application for a permit.

(1) All applicants shall submit an application. The division shall not act upon the application until they have received all required information, the appropriate fee, a passing grade on the appropriate exams, and, if applicable, proof of financial responsibility. If applicant holds a valid permit from another state with requirements similar to the State of Missouri's the applicant must also submit proof of the valid permit. Proof shall be at the discretion of the division. An application will not be acted upon or it will be denied if the applicant has violated any rules and has not remediated these violations. The division may issue a permit on a probationary status.

(2) The application shall be accompanied by the appropriate fee(s). The fee shall be made payable to the Groundwater Protection Fund. There will be no refund of monies paid for the permits after the fee has been transferred to the Groundwater Protection Fund in Jefferson City unless the request is made in writing. In the case of any change of status of any permittee, that permittee shall notify the division and submit a new application and appropriate fee required pursuant to these rules. In the case of either change in ownership of a rig or the purchase of a new rig, a new application form and the appropriate fee must be sent to the division and a new card will be issued.

*AUTHORITY: sections 256.606, 256.607, 256.611, 256.613 and 256.626, RSMo (1994).
* Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed December 3, 2008, effective March 1, 2009.
Original authority: 256.606, RSMo (1991); 256.607, RSMo (1985), amended 1991; 256.611, RSMo (1985), amended 1991; 256.613, RSMo (1991); and 256.626, RSMo (1985), amended 1991.

10 CSR 23-1.075 - Disciplinary Action and Appeal Procedures

PURPOSE: This rule outlines the procedures the division and board will take when a permittee is affected by disciplinary action.

(1) Definitions. As used in this rule, the following terms mean:

(A) Board - Well Installation Board (WIB);

(B) Department - The Department of Natural Resources, which includes the director thereof, or the person or division or program within the department delegated the authority to render the decision, order, determination, finding, or other action that is subject to review by the board;

(C) Hearing - Any presentation to, or consideration by the hearing officer of evidence or argument on a petition seeking the board's review of an action by the department;

(D) Hearing officer - Administrative Hearing Commission;

(E) Person - An individual, partnership, copartnership, firm, company, public or private corporation, association, joint stock company, trust, estate, political subdivision or any agency, board, department or bureau of the state or federal government or any other legal entity whatever, which is recognized by law as the subject of rights and duties.

(2) The division may cause an investigation to be made in order to determine whether there has been any violation of the law or of these rules and, in doing so, may request the permittee, well owner, or other individuals to appear before them to determine the merits of the situation in question. If requested individuals do not appear before the division, a determination will be made based on the available information. Any person who willfully obstructs, hinders or prevents agents of the division in the performance of the duties imposed on them by section 256.600 - 256.640, RSMo., is guilty of a class A misdemeanor and may be liable for civil and criminal penalties as set out in section 256.637, RSMo. If the division determines that the holder of any permit issued according to sections 256.600 - 256.640, RSMo; has violated any provision of this law or any rule adopted according to this law, the division shall reprimand, place a permit holder on probation, suspend or revoke a permit. For minor violations, the division will

issue a reprimand or notice of violation, the remediation required and the time period allowed to remedy the violation.

(3) As a condition of any order, the division will specify and schedule any remediation required, and will be present, if deemed necessary, while the remediation is performed. The division shall issue and serve on the permittee, a written notice of the order issued under sections 256.600 - 256.640, RSMo. The order shall specify the particular part of sections 256.600 - 256.640, RSMo., or particular rule of which the permittee is alleged to be in violation and a statement explaining the alleged violation. The order must be sent registered or certified mail, return receipt requested.

(4) Filing an Appeal or Requesting a Hearing.

(A) Any person adversely affected by a decision of the Department or otherwise entitled to ask for a hearing may appeal to have the matter heard by filing a petition with the Administrative Hearing Commission, within thirty (30) days after the date the decision was mailed or the date it was delivered, whichever date was earlier.

(B) A petition sent by registered mail or certified mail will be deemed filed on the date it is mailed. If it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the Administrative Hearing Commission.

(5) Procedures.

(A) The hearing shall be conducted in accordance with the provisions of chapter 536, RSMo, and the regulations of the Administrative Hearing Commission promulgated thereunder.

(B) Upon receipt of the hearing officer's recommendation and the record in the case, the board shall -

1. Distribute the hearing officer's recommendation to the parties or their counsel;

2. Allow the parties or their counsel an opportunity to submit written arguments regarding the recommendation;

3. Allow the parties or their counsel an opportunity to present oral arguments before the board makes the final determination;

4. Complete its review of the record and deliberations as soon as practicable;

5. Deliberate and vote upon a final, written determination during an open meeting, except that the board may confer with its counsel in closed session with respect to legal questions;

6. Issue its final, written determination as soon as practicable, including findings of fact and conclusions of law. The decision of the board shall be based only on the facts and evidence in the record; and

7. The board may adopt the recommended decision of the hearing officer as its final decision. The board may change a finding of fact or conclusion of law made by the hearing officer, or may vacate or modify the recommended decision, only if the board states in writing the specific reason for a change.

(6) All final orders and determinations of the board or the division made according to sections 256.600 - 256.640, RSMo., are subject to judicial review according to the provisions of section 536.100, RSMo. Any person who has exhausted all administrative remedies provided by chapter 536, RSMo., and who is aggrieved by a final decision in a contested case, whether the decision is affirmative or negative in form, shall be entitled to judicial review in the form of a trial de novo in the circuit court of the county where the alleged impropriety occurred.

*Authority: sections 256.600 RSMo (1986) and 256.623 and 256.630, RSMo (Cum. Supp. 1991). * Emergency Rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Jan. 9, 2007, effective March 30, 2007. *Original authority: 256.600, RSMo (1985) and 256.623 and 256.630, RSMo (1985), amended 1991.*

10 CSR 23-1.080 Denial of Application

PURPOSE: This rule describes the reasons for denial of a permit.

(1) An application for any permit or permit renewal may be denied for any of the following reasons:

(A) Failure of the applicant to accurately complete the application;

(B) Failure of the applicant to submit the application with the appropriate fee, late fee or both;

(C) Failure of the applicant to meet the experience and other qualifications required by the law and these rules or receive a passing grade on the examination;

(D) Noncompliance with sections 256.600-256.640, RSMo or with these rules; and

(E) Other sufficient causes as determined after notice and hearing in accordance with 10CSR 23-1.075.

*Auth: section 256.606, 256.611 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.611 and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.090 Permit Requirement

PURPOSE: This rule explains that a permit is required in order to construct or repair a well in the state.

(1) No person shall drill, construct, install pumps or pumping equipment, repair a well or plug a well within this state unless in possession of a valid permit to do so issued by the division. A well installation contractor's permit is valid for drilling and repair on wells that produce water for human consumption, animal, industrial or irrigation purposes, open-loop heat pump wells and water return wells. A monitoring well installation contractor's permit is valid for drilling and repair of monitoring wells and test holes. A monitoring test hole installation contractor's permit which is a restriction on the monitoring well installation permit is valid for the drilling or coring of wells in the exploration for minerals or geologic data. A heat pump installation contractor's permit is valid for drilling and repair of heat pump wells (excluding open-loop heat pump and water return wells), construction of trenched systems and installation of loops used in heat pump systems. A pump installation contractor's permit is valid for setting pumps and liners and removal of pumps for repair and/or replacement in wells that produce water for human consumption, animal or irrigation purposes. It is also valid for setting pumps in extraction type monitoring wells. All contractor's permits are valid for plugging wells, except monitoring wells must be plugged by monitoring well installation contractors. The

previously mentioned permits can be issued on a restricted or nonrestricted basis. Restricted permits are issued to persons who only contract the work specific to the type of permit requested or to primary contractor on-site drilling supervisors. All permits issued pursuant to these rules shall expire one year after issuance.

(2) Nothing in sections 256.600-256.640, RSMo shall prevent a person who has not obtained a permit pursuant to sections 256.600-256.640, RSMo from constructing or plugging a well on his/her own or leased property intended for use only in a single family house which is his/her permanent residence or intended for use only for farming purposes on his/her farm and where the waters to be produced are not intended for use by the public or in any residence other than his/her own. Each person shall comply with all rules as to construction of wells adopted under sections 256.600-256.640, RSMo. The landowner may hire an unpermitted person to plug a hand dug well but the landowner is responsible to make sure the well is plugged according to 10 CSR 23-3.110 and reported on a registration report form with the accompanying fee. All other types of wells must be plugged by a permitted contractor unless the landowner does the work as provided in this section.

Auth: sections 256.606, 256.607, 256.613, 256.615, 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Emergency rescission and emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Rescinded and readopted: Filed: Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991); 256.607, RSMo (1985), amended 1991; 256.613 and 256.615, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.105 Permit Renewal

PURPOSE: This rule outlines the procedure for renewing a permit.

The permittee shall file for the renewal with the division and submit the appropriate fee prior to the expiration date of his or her permit. Any forms that are improperly completed will be returned to the contractor for completion. A penalty fee also shall be paid if the renewal is submitted within 30 days of the expiration date. If a permit has been expired more than 30 days, permittee must reapply and take the appropriate exam to obtain a new permit. Upon receipt of any completed renewal request, renewal fee and appropriate forms completed in manner acceptable to the division, a permittee shall be sent a renewal permit if still qualified for the permit. A permit will not be renewed if the permittee has any unresolved violations pending against his or her permit, unless a schedule to remedy the violations has been approved in advance by the division. The division may issue a renewal permit on a probationary basis. The renewal permit shall consist of a card and contain the name of the permittee, expiration date and permit number. The permit card shall be carried by the permittee and the rig cards must be placed in each rig.

*Auth: sections 256.606, 256.607, 256.611 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.607, 256.611 and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.130 Reinstatement

PURPOSE: This rule describes the steps that must be taken to have a permit reinstated.

(1) A revoked permit may not be reinstated. The permittee who has had a permit revoked may be repermited by filing the usual applications and fees. The division shall require an investigation or hearing to determine whether the person should be issued a new permit; provided however that in no case shall a new permit be issued prior to one year after the revocation has taken effect.

(2) A permit suspended for a specified period of time shall be automatically reinstated at the end of that time. Nothing in these rules shall be interpreted to prevent the making of the reinstatement conditional upon terms established by the division's order of suspension.

A permittee suspended for an indefinite period of time may be reinstated at the division's own motion after due investigation to determine that the conditions upon which the suspension was based have been corrected or upon the division receiving reasonable assurance to its satisfaction that these conditions will not reoccur.

(3) A well installation, heat pump installation, monitoring well installation, monitoring-test hole installation or pump installation contractor who has had a permit revoked or a person found guilty of a Class A misdemeanor in accordance with section 256.637, RSMo shall provide to the division a performance bond or letter of credit in order to obtain a permit. Section 256.616, RSMo describes the procedures to be followed.

*Auth: section 256.606, 256.616, 256.626 and 256.630, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606 and 256.616, RSMo (1991) and 256.626, 1991 and 256.630, RSMo (1985), amended 1991.*

10 CSR 23-1.140 Placement of Permit Number

PURPOSE: This rule describes how to place the permit number on the machine.

A permittee shall place in a conspicuous location on both sides of each well drilling machine or pump installation machine the words MO PERMIT and the permit number in figures not less than three inches high and one and one-half inches wide (3" X 1 1/2"). The number shall be in a contrasting color to the background. This change is not required until new equipment is purchased, operator changes equipment, or the rig is painted. If new permit numbers are issued, they must be placed on the drilling or pump installation machine within six months.

*Auth: section 256.606, 256.617 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991); 256.617, RSMo (1985); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.155 Well Drilling and Pump Installation Machine Registration

PURPOSE: This rule describes the registration procedures for the drill and pump installation machines.

For the registration with the division of each drilling machine or pump installation service machine, the permittee will send in the appropriate application and fee. Upon receipt of the required fee and information, a well drilling or pump installation machine registration card shall be issued for identification purposes for each drilling or pump installation machine registered by the well installation, heat pump installation, monitoring well installation or pump installation contractor.

The card shall be carried on the well drilling or pump installation machine at all times where it may be inspected by the division or its representative. The card expires one year from the date of issue.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-1.160 Mail and Notification Procedures

PURPOSE: This rule informs the permittees of Division of Geology and Land Survey mailing and notification procedures.

- (1) Mail. All persons permitted by the division shall keep the division advised of current address and must readily accept all mail sent to them by the division.
- (2) Registered or certified mail sent with proper postage and last known address that is returned unclaimed shall be considered adequate notification of notice served.
- (3) The division shall be notified of any change of address within 30 days of change.
- (4) Refusal to accept mail is a violation of these regulations and may result in disciplinary action. Mail not accepted by the permittee that has proper postage and last known address shall be considered adequate notification.

*Auth: section 256.600, RSMo (1986).
Amended: Filed Nov. 1, 1995, effective
June 30, 1996. *Original rule filed
April 18, 1990, effective June 28, 1990.
Original authority 1985.

Chapter 2

**Well Drillers
and
Pump Installers Permitting**

Title 10 - DEPARTMENT OF NATURAL RESOURCES
Division 23 - Division of Geology and Land Survey

Chapter 2 - Well Drillers and Pump Installers Permitting

10 CSR 23-2.010 Fee Structure

PURPOSE: This rule establishes a fee structure to be used in permitting well installation, pump installation, heat pump installation, monitoring well installation, employee and drilling supervisor contractors and in certification and/or registration of wells and for examinations relating to permit applications.

(1) Each well installation, heat pump installation, monitoring well installation, monitoring-test hole installation, and pump installation contractor will pay a yearly permit fee of no more than \$150 for each type of permit issued. Each drilling machine or pump service rig will be charged a yearly fee of no more than \$50 each.

(2) Well certification fees will be paid by the well owner and collected and submitted by the well installation or pump installation contractor and will be sent to the division by the contractor within 60 days of completion. This fee will be no more than \$125 per well.

(3) Well registration fees will be paid by the well owner and collected and submitted by the well installation, heat pump installation, monitoring well installation, monitoring-test hole installation or pump installation contractor within 60 days of completion. Registration report forms are required for plugging of wells, raising of casing, lining of wells, deepening of wells, major repairs and alteration to wells and drilling of jetted wells unless exempted. Concerning the plugging of mineral exploratory wells, the company or person for whom the well is drilled must pay the fee and submit a registration report form. When work performed on a well fits the registration report criteria, and that work is performed by the well owner, the well owner is required to submit the appropriate form and fee. This fee will be no more than \$100 per well. Documentation for holes drilled and plugged under the requirements of 10 CSR 23-6.010 – 10 CSR 23-6.060 must be submitted on a registration report form.

(4) Monitoring well certification fees will be paid by the owner or primary contractor, collected within 60 days of completion and submitted to the division by the monitoring well installation contractor. This fee will be no more than \$125 per well.

(5) Open-loop and closed-loop heat pump well certification fees will be paid by the owner and collected and submitted by the heat pump installation contractor to the division within 60 days of completion. This fee will be determined by the ton rating of the heat pump machine as shown in the following. When more than one heat pump machine is hooked together, the cumulative total of the ton rating will be used to determine the fee. The fee will be no more than:

(A) One to 50 ton heat pump unit \$150,

(B) Over 50 ton heat pump unit \$250.

(6) A penalty fee of no more than \$10 a month for up to 24 months will be charged to the contractor for any registration report form or certification report form received more than 60 days after the date of completion of the appropriate activity. Two hundred and forty dollars will be the maximum late fee per certification or registration report form. The division will provide each permitted contractor with a list of the certification and registration report forms that have been submitted to the division, if requested by the permitted contractor, once per calendar year at no charge.

(7) A penalty fee of no more than forty percent of the permit fee per year will be assessed when a well installation, heat pump installation, monitoring well installation, monitoring-test hole installation or pump installation contractor fails to either apply or reapply for a permit after the deadline unless they are no longer operating in Missouri. The deadline for original permitting is Oct. 1, 1987, or the date the contractor begins operating in Missouri, whichever date is latest. The deadline for original permitting for a monitoring well installation or heat pump installation contractor is March 10, 1994, or the date the contractor begins operating in Missouri, whichever is latest. The deadline for repermitting is the expiration date on the well installation, heat pump installation, monitoring well installation, monitoring-test hole installation or pump installation contractor's current permit card.

(8) All requests for lists, copies of the corresponding rules, reports or other publications offered through the division relating to the implementation of the rules under the Well Installation Board will be available for no more than the actual cost incurred by the division.

(9) When a request for the logging of wells, core or cuttings is received, the log may be done for a fee of no more than the actual costs involved in production of the log.

(10) Testing fees will be no more than as listed:

(A) General Test \$50;

(B) Well Driller Contractor Test \$50;

(C) Pump Contractor Test \$50;

(D) Heat Pump Contractor Test \$50;

(E) Monitoring Well Contractor Test \$50;

(F) Monitoring-Test Hole Contractor Test \$50;

(G) Retakes (for each test) \$50.

*Auth: sections 256.606, 256.614, 256.623 and 256.626 (Cum. Supp. 1991). Emergency rule filed July 2, 1986, effective July 12, 1986, expired November 2, 1986. *Original rule filed July 2, 1986, effective October 27, 1986. Emergency amendment filed May 16, 1988, effective May 26, 1988, expired Sept. 22, 1988. Amended: Filed May 16, 1988, effective Aug. 26, 1988. Amended: Filed April 18, 1990, effective June 28, 1990. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed June 15, 1998, effective Aug. 30, 1998. Amended: Filed November 20, 2008, effective February 1, 2009. Original authority: 256.606, RSMo (1991) and 256.614, 256.623 and 256.626, RSMo (1985), amended 1991.*

Chapter 3

Well Construction Code

Title 10 - DEPARTMENT OF NATURAL RESOURCES
Division 23 - Geology and Land Survey

Chapter 3 - Well Construction Code

PURPOSE: The rules contained in Chapter 3 cover wells drilled for the purpose of obtaining water for drinking, irrigation, live stock or other uses but does not apply to heat pump wells or monitoring wells unless referenced in applicable chapter. Rules covering these types of wells are contained in Chapters 4 and 5.

10 CSR 23-3.010 Location of Wells

PURPOSE: This rule sets criteria as to the areas a well should be placed.

(1) A well shall be located consistent with the general layout and surrounding area giving due consideration of the size of the lot, contour of the land, the water table, soil deposits, rock formation, local groundwater conditions and other factors necessary to implement the basic policies that follow:

(A) A well shall be

1. Located on a site which has good surface drainage and, if possible, at a higher elevation than possible sources of contamination. The top of the casing shall extend at least one foot above the finished surface grade;
2. Located so that the well and its surrounding area can be kept in a sanitary condition and provide ready access for repairs, maintenance and inspection;
3. Adequately sized, designed and developed for the intended use;
4. Constructed so as to maintain existing natural protection against pollution of water-bearing formations and to exclude all known sources of contamination from the well, including sources of contamination from adjacent property;

5. Located so that proper drainage in the vicinity of the well shall be provided so as to prevent the accumulation and ponding of surface water within 10 feet of the well; and

6. If at all possible, located in areas that do not flood. If no reasonable alternative site exists, wells may be constructed in floodplains provided special construction is included. The casing of the well shall terminate not less than two feet above the maximum known flood water elevation or when flooding is imminent, well vent must be sealed and well discontinued from operation until floodwater subsides.

(2) Lateral Distances from Pollution or Contamination Sources.

(A) A well shall be at least

1. Three hundred feet from a storage area for commercial fertilizers or chemicals, landfill, lagoon, above ground or underground storage tank, distribution lines for liquid petroleum, petroleum products or chemicals. Petroleum or petroleum products that are not liquid at standard temperatures and pressures are exempt from these set back requirements;
2. Three hundred feet from earthen, concrete or other manure storage structures or lagoons, from land application areas for domestic or animal waste and from animal composting facilities except as stated in section (2)(A)4 of this rule;
3. One hundred feet from cesspools and unplugged abandoned wells, except as noted in paragraph (2)(A)6 of this rule.

4. One hundred feet from a subsurface disposal field, grave, single family lagoon, building or yard used for livestock or poultry, bird composting facility constructed with a concrete floor cell design covered with a roof, dry litter storage within a poultry building as accumulation of litter occurs during normal facility operations, privy or other contaminants that may drain into the soil;

5. Fifty feet from a buried sewer, septic tank or sewer holding tank, a pit or unfilled space below ground surface, a sump, an existing operating well, except that a well may be drilled closer than 50 feet to a basement and an above ground petroleum storage tank if it is necessary for the operation of the well pump;

6. Wells with casings less than 80 feet in depth and not encountering at least 10 feet of impervious material shall be located at least 150 feet from cesspools and unplugged abandoned wells and at least 150 feet from a subsurface disposal field, and septic tank, manure storage pile or similar source of contamination. For example, a manure storage pile would be considered as a potential source of contamination to the well; however, the presence of animals in open pasture in an area would not necessarily concentrate contaminants to the degree that would cause contaminants to enter the groundwater; and

7. Ten feet from the right-of-way of any federal, state or county road.

(B) Waste landfill or lagoons. The safe distance that a well should be located from a waste landfill or waste stabilization pond (lagoon) cannot be assigned a fixed number because of the varieties of hydrologic and geologic parameters associated with the undetermined types and amounts of materials that may be carried by groundwater from

leachates discharged from the waste landfill or waste stabilization ponds (lagoons). It is recommended that wells not be located in an area between the landfill or waste stabilization ponds (lagoons) sites and the point of groundwater discharge to a surface water source. Any well that may intercept leachates from a waste landfill or waste stabilization pond (lagoon) by water withdrawal from the well shall not be used for human consumption and must be plugged unless it is used for a monitoring well.

(C) Irrigation wells require increased setbacks and shall be at least 200 feet from

1. Sewer lines, septic tanks, lateral fields, pit privy, seepage pits, feed lots, barnyards, fuel, fertilizer and pesticide storage. Fuel, fertilizer and pesticide tanks up to 1,000 gals. in capacity will be allowed at well while irrigating and chemigating but must be removed from well site when not in use; and

2. Any well producing potable water.

*Auth: section 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed November 1, 1995, effective June 30, 1996.*

**Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.020 General Protection of Groundwater Quality and Resources

PURPOSE: This rule is for the overall protection of water quality and resources in Missouri.

(1) Reuse of Water, Disposal, Recharge or Gas Storage Wells.

(A) A well for the storage of gas or liquid under pressure may not be drilled without first having secured a permit from the Department of Natural Resources in accordance with the Missouri Statutes.

(B) Water used for cooling parts of engines, air compressors or other equipment shall not be returned to any part of the groundwater system. A well shall not be used for disposal or injection of any substance, including surface water, groundwater or any liquid, gas or chemical associated with the drilling of an oil or gas well, including coal bed methane wells, without first receiving a permit from the Underground Injection Control Program's rules 10 CSR 50-2, Oil and Gas Council, Oil and Gas Drilling and Production. A permit through the Division of Environmental Quality, Water Pollution Control Branch may be required.

(C) A well previously used for storage of gas or liquid under pressure may not be converted to a well used for water supply.

(2) Maintenance and Repair of Wells.

(A) Every well shall be maintained by the owner in a condition where it will conserve and protect the groundwater resources and where it will not be a source or channel of contamination or pollution to the water supply of that well or any aquifer.

(B) All materials used in maintenance, replacement or repair of any well subject to these rules shall meet the requirements of these rules for new installation.

(C) Broken, punctured or otherwise defective or unserviceable casing, screens, fixtures, seals or any part of the wellhead shall be repaired or replaced. The well shall be plugged in accordance with the requirements of these rules if that repair or replacement is not performed.

(D) Repairs to wells originally completed with the wellhead terminating below ground (buried seal) should include extending the well casing one foot above the finished surface grade. The casing extension material must be of similar material to the original casing (for example, steel to steel and plastic to plastic). On steel casing the joint must be welded, coupled or threaded. On plastic casing, the joint must be glued or fused.

All joints and extensions must be sealed to prevent contamination from entering the groundwater.

Sealing material must not be a contaminant such as tar. When this type of repair to a well is completed, it must not move at the joint under normal operating conditions. The use of devices specially designed to join dissimilar casing materials together will be considered on a case-by-case basis by the division. Approval must be received in advance.

(3) Cross connections between wells and other systems or equipment containing water or other substances of unknown or questionable safety, including pesticides and fertilizers, are prohibited, except where equipped with a suitable protective device such as a break tank or backflow preventor which is approved by the division and which the owner agrees to install, test and maintain to assure proper operation.

(4) All other wells except those specifically exempted by the law shall be constructed and maintained in accordance with standards from the division.

*Auth: section 256.606, 256.614, 256.615 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991); 256.614, RSMo (1985), amended 1991; 256.615, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.025 Public Water Supply - Notification to Division

PURPOSE: This rule establishes requirements regarding notification by a public water supplier to the division when a well is to be abandoned in order to connect a structure to a public water supply system.

(1) Public water supplier notification requirements concerning abandoned wells (as stated in chapter 256.628, RSMo).

(A) A public water supplier subject to the provisions of Chapter 640, RSMo which connects to any structure or location previously serviced by any well that is not that of another public water supplier shall notify the well owner of his or her obligation to plug any abandoned well pursuant to the requirements of section 256.628, RSMo. The public water supplier shall not connect any person to the public water system until the person submits information which identifies the location of wells and attests that

1. Existing wells will remain in use and will be properly plugged when no longer used;
2. Known abandoned wells on the property have been plugged;
3. There are no known abandoned wells on the property; or
4. Any abandoned wells will be plugged within 90 days.

(B) The public water supplier shall submit a copy of information to the division within 60 days of connection on forms provided by the division, along with sufficient information to enable the division to locate existing and abandoned wells. The division shall inspect, within a reasonable time, any well identified in paragraph (1)(A)4. of this rule. If the division determines that an abandoned well has not been plugged, it shall order the owner to have it plugged by a permitted well installation contractor or permitted pump installation contractor within thirty (30) days. The division shall immediately seek injunctive relief through the office of the prosecuting attorney of the county where the alleged violation occurred to

enforce its order and shall notify the appropriate public water supplier who shall terminate water service to the property 30 days after receipt of notice if the well has not been plugged. Any person who fails to plug an abandoned well pursuant to the provisions of this subsection shall be subject, upon conviction, to the penalties specified in section 256.637, RSMo.

*Auth: sections 256.606 and 256.628, RSMo (Cum. Supp. 1991). * Original rule filed August 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. *Original authority: 256.606, RSMo (1991); 256.614, RSMo (1985), amended 1991; 256.615, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.030 Standards for Construction of Wells

PURPOSE: This rule describes the minimum standards for a properly constructed well but does not apply to community or noncommunity public water supply wells. It is the obligation and responsibility of the driller to construct community and noncommunity wells following procedures set forth by the Missouri Public Drinking Water rules.

(1) Casing for Permanent Wells. Steel well casing used for the outside casing must be new and shall be of at least six-inch nominal size (6.625 outside diameter in inches, actual dimensions), 13 pounds per foot, 0.188 wall thickness. Coated casings are permitted as long as they are not a source of contamination to the groundwater. Larger diameter casing shall have minimum weights and thicknesses as specified in subsection (1)(G) of this rule. Concrete casing is permitted for use. Casing for permanent wells shall be of ferrous material, or where permitted by rule, plastic or concrete material. For ferrous pipe, the specifications and installation procedures are prescribed as follows. For plastic pipe, the specifications and installations procedures are prescribed in 10 CSR 23-3.070.

(A) Casing Joints. A protective well casing shall have watertight joints throughout its length. The joints shall be made by being continuously welded, threaded or other types of joints given written approval by the division. Tongue and groove type of joints are acceptable for concrete casings. Recessed or reamed and drifted couplings shall be used on threaded casing, or as an alternate, other couplings can be used but the design, taper and type of thread of the coupling shall match that of the pipe. Other casing design or materials shall be approved only by official written order of the division.

(B) Standard for Pipe. Pipe used as the casing in the permanent construction of a well shall be new pipe produced to recognized standards of the American Society for Testing and Materials, A53 grade A or B, A500 grade A or B, or A589 or other weldable new pipe having a quality equal to or greater than those specified. New pipe, when salvaged within 30 days of the drilling of a well for water supply may be used as new pipe if still in new condition and must be decontaminated.

(C) Inside casing diameter. Under no condition shall the casing inside diameter be less than six inches unless specifically exempted in 10 CSR 23-3 except for a driven well point or jetted well which shall be equipped with a casing pipe of at least one and 1 1/4 inches inside diameter. The well shall also be of sufficient diameter to receive a pump or pumping apparatus of sufficient size to discharge the design capacity including anticipated decline in water levels.

(D) Vertical Extension. A well casing or its extension shall extend vertically at least one foot above the finished surface grade. If the well is located in a flood plain see 10 CSR 23-3.010 (1)(A)6 for requirements.

(E) A table of minimum specifications for steel casing for domestic, multifamily, high yield and unconsolidated material irrigation wells and bedrock irrigation wells follows: (A variance must be obtained in advance from the division to install casing not on this table.)

(2) Minimum Protective Depths of Well Casing. All wells shall be watertight to such depth as may be necessary to exclude contaminants. A well shall be constructed so as to seal off formations that are likely to pose a threat to the aquifer or human health. Requirements will be fulfilled to the minimum extent when the protective casing has been installed in conformity with the applicable construction set forth in 10 CSR 23-3.030 - 10 CSR 23-3.110. Sections (17)-(20) state the amount of grout needed to fill the minimum required amount of annular space in the different areas across Missouri. Where it is not feasible to follow the standards contained in this part, the permittee shall obtain approval of the division as to the design of the well before proceeding. The acceptability of the formation for well development shall be based on the satisfactory results of analysis of the water. Any water-bearing formation yielding water which is contaminated, as evidenced by the presence of chemicals or bacteria which may be harmful, shall be regarded as unsatisfactory for use as a potable supply unless adequate treatment is provided. The division will decide acceptable water treatment measures only after all well construction remedies have been exhausted.

STEEL CASING TABLE

Domestic, Multi-family Well

Nominal pipe size In Inches	Outside Diameter In Inches	Wall Thickness In Inches	Weight/foot
6	6.625	.188	13 lbs.

High Yield and Bedrock Irrigation Well

Nominal Pipe Size In Inches	Outside Diameter In Inches	Wall Thickness In Inches	Weight/foot
6	6.625	.280	19 lb.
8	8.625	.322	29 lb.
10	10.75	.365	40 lb.
12	12.75	.375	50 lb.
14	14.00	.375	55 lb.
16	16.00	.375	63 lb.
18	18.00	.375	71 lb.
20	20.00	.375	79 lb.
22	22.00	.500	115 lb.
24	24.00	.500	125 lb.
26	26.00	.500	136 lb.
28	28.00	.500	147 lb.
30	30.00	.500	158 lb.
32	32.00	.500	168 lb.
34	34.00	.500	179 lb.
36	36.00	.500	190 lb.

Unconsolidated Material Irrigation Well

Nominal Pipe Size In Inches	Outside Diameter In Inches	Wall Thickness In Inches	Weight/foot
6	6.625	.188	13 lb.
8	8.625	.188	17 lb.
10	10.75	.188	21 lb.
12	12.75	.188	25 lb.
14	14.00	.188	28 lb.
16	16.00	.188	32 lb.

(3) Grouting.

(A) Grouting Required for Wells. It is the obligation and responsibility of the well installation contractor to ensure that the annular space is sealed and that the casing does not leak. This obligation and responsibility ends three years after the date of certification unless it can be shown that the well seal has been damaged by other persons. The following is a list of approved grouting methods:

1. Gravity installation method. The grout is poured into the annular space without the use of a tremie or grout pipe. Cement or bentonite slurry may never be poured through standing water without the use of a tremie pipe. The Gravity Grouting Table is a table which states the minimum requirements concerning the depth that grout can be gravity fed in wells that have an annulus from one to two inches. This table reflects the use of actual drill bit sizes and a 6 5/8ths inch outside diameter casing. Nominal sizes may not be used when determining the annular space. Contact the division for instructions concerning grouting wells with larger than a two-inch annulus.

Note: When using plastic casing, a larger hole is recommended due to the belled casing ends reducing the annular space.

2. Tremie method. In this method the grout is placed in the annular space by gravity through a tremie or grout pipe suspended in the annular space. The tremie pipe is placed into the annulus and extends to within five feet from the bottom of the interval to be grouted. The grout is added into the tremie pipe which should remain submerged in the grouting material during the entire time the grout is being placed. The tremie pipe is gradually withdrawn as the grouting material is placed or may be removed after the annular space is full and before the grout sets;

3. Pressure grouting through tremie method. For this method the same procedure is followed as described in the tremie method, except the grout is pumped into the tremie pipe instead of placed by gravity flow;

4. Pressure grouting through the casing method. Instead of using a tremie pipe placed in the annular space a grout pump is attached to the top of the casing and grout pumped through the

casing and allowed to fill the annular space from the bottom. Pumping continues until grout reaches the surface of the annular space. Grout must be allowed to set up before drilling continues;

5. Open-hole method. Grout is poured into the drill hole from the surface and allowed to fill the drill hole to the required level. Note: much more grout is required to fill the bottom 30 feet of drill hole when using the open-hole method. See 10 CSR 23-3.030 (17-20) for specific amounts. Then the casing is placed into the drill hole through the grouting material. This method may not be used if water is standing in the drill hole unless grout is placed by one (1) of the tremie grouting methods; or if bentonite chips are used, they must be allowed to completely hydrate before the casing is pushed into the grout.

6. Positive displacement method. Casing is set into the borehole to a point about five feet above the casing point. Grout is poured into the well casing followed by a drillable plug. This is designed to push all grout to the bottom of the well. If there is water in the borehole and bentonite or cement slurry is used it must be emplaced via a tremie to the bottom of the borehole. The plug is pushed to the bottom of the casing forcing the grout down the inside of the casing and up the annular space. The casing is then set into the bottom of the drill hole; and

7. Other grouting methods must be approved by the division in advance.

(4) Approved Grouting Materials.

(A) Neat Cement Grout. Neat cement grout is a mixture of one bag, 94 pounds of Portland cement (ASTM C150) to not more than six gallons of clean water. Bentonite, up to six percent by weight of cement to reduce shrinkage or other additives (ASTM C688) to reduce permeability or control time of set or both, may be used. If bentonite is used, additional water should be added to the mix.

(B) Bentonite Grout. Sodium bentonite (swelling clay) is available in many forms from granules to pellets to chips. When grouting annular spaces with nonslurry bentonite, great care must be exercised to ensure the bentonite is placed properly. Flash swelling may occur and bridge off the annular space preventing an

Gravity Grouting Table

Size Hole(inches)	Outside Diameter of Casing (inches)	Annular Space (inches)	Gravity Feed Depth (feet)
8 5/8	6 5/8	1	100
8 3/4	6 5/8	1 1/6	106
8 7/8	6 5/8	1 1/8	112
9	6 5/8	1 3/16	119
9 1/8	6 5/8	1 1/4	125
9 1/4	6 5/8	1 5/16	131
9 3/8	6 5/8	1 3/8	137
9 1/2	6 3/8	1 7/16	144
9 5/8	6 5/8	1 1/2	150
9 3/4	6 5/8	1 9/16	156
9 7/8	6 5/8	1 5/8	162
10	6 5/8	1 11/16	169
10 1/8	6 5/8	1 3/4	175
10 1/4	6 5/8	1 13/16	181
10 3/8	6 5/8	1 7/8	187
10 1/2	6 5/8	1 15/16	193
10 5/8	6 5/8	2	200

adequate seal when using powdered, granular, tablets or pelletized bentonite. Therefore, only bentonite specifically designed to prevent flash hydration and to fall through standing water may be used. Chipped or pelletized bentonite may not be used in annular spaces less than one inch. Bentonite must be applied slower than manufacturer's specifications. If there is no water in the annular space, the bentonite must be hydrated after each bag or water poured into the hole before application of the bentonite.

(C) Bentonite Slurry Grout. Sodium bentonite slurry grout is a bentonite/water mixture. There are many additives available that effect viscosity and set-up time. These additives are acceptable unless they are a potential contaminant. Bentonite slurry must have a solids content of at least twenty percent.

(D) Other Grout Types. Other types of grout may be used when necessary if prior approval by the division is granted.

(5) Drill cuttings used by themselves or in conjunction with a drive shoe, packer or boot are not approved materials for grouting the annulus of any well.

(6) Grouting required for Community and Noncommunity Public Water Supply Wells. It is the obligation and responsibility of the driller to follow procedures set forth by the Missouri Public Drinking Water Rules.

(7) Driven Casing Wells. The bottom of the steel well casing shall be equipped with a drive shoe or otherwise protected from damage during construction of the well as dictated by drilling procedures and conditions of each particular well (see 10 CSR 23-3.100(4)(D)3 for grouting techniques).

(8) Capping. Temporary capping of a well until the pumping equipment is installed shall allow no pollution or foreign objects can enter the well.

(9) Alignment. A well shall not vary from the vertical alignment so as to interfere with installation and operation of the pump.

(10) Well Development. The well shall be developed to remove any material deposited on the aquifer face during the drilling, drilling fluid and the predetermined finer fraction of a gravel pack, all of which shall be done to ensure that the maximum practical specific capacity will be obtained from the completed well.

(11) For further construction requirements for domestic wells see 10 CSR 23-3.090 Regionalization and 10 CSR 23-3.100 Sensitive Areas.

(12) Multifamily Wells are water supply wells constructed for the purpose of serving more than three dwellings but having less than 15 service connections and regularly serves less than 25 individuals daily at least 60 days out of year. A multifamily well must be constructed as follows:

(A) Minimum casing lengths for multifamily wells are the same as domestic wells. Liner may not substitute for casing;

(B) The drill hole shall be constructed a minimum of 10 inches in diameter. An increase in hole size to 10 5/8 inches in diameter will be effective May 1, 1999. The drill hole must be at least four inches in diameter larger than the outside diameter of the steel casing to be installed;

(C) The casing used must be of ferrous material and conform to size, wall thickness and weight/foot parameters set out in subsection (1)(E), for multifamily wells. Plastic casing may be used if approved in advance on a case-by-case basis;

(D) The casing must be grouted full-length with grout utilizing the tremie method or one of the pressure grouting methods set out in section (3) of this rule;

(E) The neat cement grout must be allowed to set up based on the parameter of the following:

1. Hi-early cement - minimum of 12 hours;
2. Portland Type I cement - minimum of 72 hours; and
3. High solids bentonite slurry - varies based on additives and manufacturer's specifications; and

(F) When drilling starts, after cement has set, care should be taken when drilling out the bottom of the casing so that curing cement is not damaged.

(13) Unconsolidated Material Irrigation Well. A well drilled into alluvial, glacial drift or glacial outwash aquifers that is not deeper than 200 feet and produces water not for human consumption shall conform to the following construction requirements:

(A) The selection of casing shall take into consideration the stress to which the pipe will be subjected during construction and the corrosiveness of the groundwater. Used pipe is prohibited. If steel casing is selected, see subsection (1)(E) Steel Casing Table, for size, wall thickness and weight per foot specifications. If plastic casing is selected (see 10 CSR 23-3.070 for specifications);

(B) Unconsolidated material irrigation wells greater than 200 feet in depth must be constructed using bedrock irrigation specifications contained in section (14);

(C) The drill hole shall be constructed a minimum of four inches in diameter larger than the outside diameter of the casing to be installed;

(D) Set Screen and Casing. Screen openings shall provide the maximum amount of open area consistent with strength of screen and the grading of the water-bearing formation and gravel pack. The openings shall permit maximum transmitting ability without clogging or jamming;

(E) Gravel Pack. All gravel placed into well shall be clean, washed and disinfected prior to placement or provisions made for disinfection in place. When an over-sized drill hole is constructed to permit the placement of a gravel wall around the well screen and casing, grouting and sealing may be suspended for 60 days to allow for gravel to settle and for well development; and

(F) Grouting. After the well has been developed and pumped, but in no case later than 60 days, dig around the well to a depth of four feet to five feet and fill with sodium bentonite granules, pellets, tablets or chips. Bentonite slurry or organic polymers shall not be used.

(14) Bedrock Irrigation Well. These wells are drilled into bedrock aquifers that are constructed to meet required standards and are equipped with a pump that has the capacity to produce more than 70 gallons of water per minute. The produced water is for irrigating crops but may be used for human consumption. This type of well shall conform to the following construction requirements:

(A) The minimum amount of casing set must be determined by the division in advance on a casing point request form. A casing point request form is available from the division;

(B) The drill hole shall be constructed a minimum of 10 inches in diameter. The drill hole must be at least 4 inches in diameter larger than the outside diameter of the steel casing to be installed;

(C) The casing used must be of ferrous material and conform to size, wall thickness and weight/foot parameters set out in subsection (1)(E), for high yield and bedrock irrigation wells; and

(D) The casing must be grouted full-length with neat cement grout utilizing the tremie method or one of the pressure grouting methods set out in section (3).

(15) High Yield Well. Those wells that are constructed to meet required standards and are equipped with a pump that has the capacity to produce more than 70 gallons of water per minute.

(A) The minimum amount of casing set must be determined by the division in advance on a casing point request form. A casing point request form is available from the division.

(B) The drill hole a minimum of 10 inches in diameter shall be constructed. The drill hole must be at least four inches in diameter larger than the outside diameter of the steel casing to be installed.

(C) The casing must be of ferrous material and conform to size, wall thickness and weight/foot parameters set out in subsection (1)(E), for high yield and bedrock irrigation wells.

(D) The casing must be grouted full-length with neat cement grout utilizing the tremie method or one of the pressure grouting methods set out in section (3).

(16) Lubricants Used During the Drilling Process. During the drilling of a well, some lubricants may be necessary to ensure protection of the drilling machine. The lubricants used must not adversely affect the groundwater quality and must be biodegradable.

Special care must be taken to ensure leaking hoses on the drilling machine do not allow harmful lubricants or fluids to enter the borehole.

(17) Most domestic bedrock wells drilled in the state have an 8 5/8 inch hole drilled to casing point and a 6 5/8 inches outside diameter casing installed into bedrock.

The rules state that the bottom 30 feet of the annulus must be grouted. Table 1 states the minimum amount of grout required to fill the bottom 30 feet of annulus taking into account the use of a 6 5/8 inch outside diameter casing, borehole size differences, type of grout utilized, and method of emplacement of the grout.

(18) Most alluvial domestic wells drilled in the state have a 10 5/8 inch hole drilled and a 6 5/8 inch outside diameter casing installed. The rules state that the top 20 feet of annulus must be grouted.

The following amount of grout are necessary, at a minimum, to fill this space:

Table 2 states the minimum amounts of grout required to fill the top 20 feet of annulus taking into account the use of 6 5/8 inch outside diameter casing and screen, borehole size differences, type of grout used, and method of emplacement of the grout.

(19) When drilling in Area 2 or 3, under certain circumstances, domestic wells may be constructed where the upper 40 feet of annulus is grouted. This annulus is created by a 10 5/8 inch hole and a 5 1/2 inch outside diameter casing. The following amounts of grout are necessary, at a minimum, to fill this space:

(20) Domestic wells drilled in Area 5 can have casing as small as 4 1/2 inch outside diameter placed in a hole that is 8 5/8 inch in diameter. To grout the upper 20 feet of this type of well the following amounts of grout are necessary, at a minimum, to fill this space:

Auth: sections 256.606, 256.614, 256.615 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991); 256.614, RSMo (1985), amended 1991; 256.615, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.040 Well Casing Seals and Connections

PURPOSE: This rule describes the types of well casing seals and connections that are to be used.

(1) Above-Grade Connections. An above-grade connection into the top or side of a well casing shall be at least one foot above the finished grade surface and constructed to exclude dirt or other foreign matter by one or more of the following methods, as may be applicable:

- (A) Threaded connection;
- (B) Welded connection;
- (C) Rubber expansion sealer;
- (D) Bolted flanges with rubber gaskets;
- (E) Overlapping well cap; and
- (F) Extension of the casing at least one inch into the base of a power pump.

Table 1

Number of Bags for Minimum Amount of Required Grout for a Domestic Bedrock Water Well												
Outer Diameter of Steel/Plastic Casing: <u>6 5/8 inches</u>				Minimum Length of Grout: <u>30 feet</u>								
Borehole Diameter	8 5/8"		8 3/4"		9"		10"		10 5/8"		11"	
	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.
Type of Grout												
<u>CEMENT</u>												
Portland Type I	5	11	5	11	6	12	8	15	10	17	12	18
Portland Type III	5	11	5	11	6	12	8	15	10	17	12	18
<u>BENTONITE</u>												
<u>Pellets—</u>												
1/2" Baroid Pellets	7	17	7	17	8	18	13	22	15	25	17	27
3/8" Baroid Pellets	7	17	8	18	9	19	13	23	16	27	18	28
1/4" Baroid Pellets	7	17	8	18	9	19	13	23	16	26	18	28
Wyo-Bend Tablets	8	18	8	19	9	20	14	25	17	28	19	30
Volclay 1/2"	8	19	8	19	9	20	14	25	17	28	19	30
Volclay 3/8"	8	19	8	20	10	21	14	26	18	29	20	31
Volclay 1/4"	8	20	9	20	10	22	15	27	18	30	21	32
<u>Chips—</u>												
Baroid HolePlug	7	18	8	18	9	19	13	24	16	27	18	29
Wyo-bend Coarse	6	15	7	15	7	16	11	20	14	22	15	24
Wyo-bend Medium	6	15	7	16	8	17	12	21	14	23	16	25
Volclay Coarse	7	16	7	17	8	18	12	22	15	25	17	27
Volclay Medium	7	17	7	17	8	18	13	23	16	26	17	27
<u>Granular—</u>												
Benseal	6	15	7	16	8	17	12	21	14	23	16	25
Wyo-bend No. 8	6	15	7	15	7	16	11	20	14	22	15	24
Wyo-bend No. 16	6	15	7	15	7	16	11	20	14	22	15	24
<u>Slurry—</u>												
Baroid	1	4	2	4	2	4	3	5	3	5	4	6
Wyo-bend	2	4	2	4	2	4	3	5	4	6	4	6
Volclay	1	3	2	4	2	4	3	5	3	5	4	6
*Ann. = Bags needed to fill Annular Space **O.H. = Bags needed to fill the Open Bore Hole												

(2) In wells that use an above grade connection, special attention must be paid to the sealing capabilities of the selected well casing seal. In many cases the electric wire hole, the drop pipe hole and the vent pipe hole may not be sealed adequately. The casing seal must stop all bacteria from entering the well through the seal. It is recommended that these holes be caulked, with silicone caulk or equivalent, to ensure that bacteria or other contaminants are not pulled into the well when the pump is operating.

(3) The practice of cutting the rubber well seal to make removal and reinstallation easier is strictly prohibited.

(4) Below-Grade Connection. A connection to a well casing made below ground, or less than one foot above the finished surface grade, shall be protected by a pitless adapter or pitless unit. The pitless adapter or pitless unit shall be composed of material of sufficient strength to withstand normal operating stress. A below-ground connection shall not be submerged in water at the time of installation. Holes cut in the casing through which the pitless adapters are installed must be sized and constructed so as to guarantee a watertight seal with the pitless adapter in place. Native materials

Table 2

Number of Bags for Minimum Amount of Required Grout for Domestic Unconsolidated Water Wells										
Outer Diameter of Steel/Plastic Casing: 6 5/8 inches Minimum Length of Grout: 20 feet										
Borehole Diameter	10 5/8"		12 5/8"		14 5/8"		16"		18"	
	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.
Type of Grout										
<u>CEMENT</u>										
Portland Type I	7	11	12	16	17	21	21	26	28	32
Portland Type III	7	11	12	16	17	21	21	26	28	32
<u>BENTONITE</u>										
<i>Pellets—</i>										
1/2" Baroid Pellets	10	17	17	24	25	32	32	38	42	48
3/8" Baroid Pellets	11	18	18	25	27	33	33	40	44	51
1/4" Baroid Pellets	11	18	18	25	26	33	33	40	44	50
Wyo-Bend Tablets	11	19	19	26	28	35	35	42	46	53
Volclay 1/2"	11	19	19	27	28	36	35	43	47	54
Volclay 3/8"	12	19	20	27	29	37	36	44	48	56
Volclay 1/4"	12	20	20	28	30	38	38	45	50	57
<i>Chips—</i>										
Baroid HolePlug	11	18	18	25	27	34	34	41	44	51
Wyo-bend Coarse	9	15	15	21	23	28	28	34	37	43
Wyo-Bend Medium	9	15	16	22	23	29	29	35	38	44
Volclay Course	10	17	17	23	25	31	31	38	42	48
Volclay Medium	10	17	17	24	26	32	32	39	42	49
<i>Granular—</i>										
Benseal	9	16	16	22	23	29	29	35	39	45
Wyo-bend No. 8	9	15	15	21	23	28	28	34	37	43
Wyo-bend No. 16	9	15	15	21	23	28	28	34	37	43
<i>Slurry—</i>										
Bariod	2	4	4	5	6	7	7	8	9	10
Wyo-bend	2	4	4	5	6	7	7	9	10	11
Volclay	2	3	4	5	5	7	7	8	9	10
*Ann. = Bags needed to fill Annular Space **O.H. = Bags needed to fill the Open Bore Hole										

<u>Grout Material</u>	<u>Size</u>	<u>Amount to Fill 40' of Annulus</u>	
		<u>Open-hole Method</u>	<u>All Other Methods</u>
Bentonite (50 lb. bag)	Medium chip	30 bags	21.5 bags
	Coarse chip	30 bags	21.5 bags
	#8 mesh (cannot be poured through water)	30 bags	21.5 bags
Cement Slurry (one 94 lb. bag with 6 gallons water)(must be tremied through standing water)		23 sacks	16.5 sacks

<u>Grout Material</u>	<u>Size</u>	<u>Amount to Fill 20' of Annulus</u>	
		<u>Open-Hole Method</u>	<u>All Other Methods</u>
Bentonite (50 lb. bag)	Medium chip	10 bags	7 bags
	Coarse chip	10 bags	7 bags
	#8 mesh (cannot be poured through water)	10 bags	7 bags
Cement Slurry (one 94 lb. bag with 6 gallons water)(must be tremied through standing water)		7.5 sacks	5.5 sacks

shall be packed tightly around the casing and pitless adapter or pitless unit after installation.

(5) Well Caps for Wells Using Pitless Adapters. Well caps used on wells that have a pitless adapter or pitless unit must have a screened vent hole pointing downward at least one-half inch in diameter and must seal tightly against the casing so as to exclude dirt, insects or any foreign matter from entering the well. Hub cap type well caps that are secured to the casing by set screws that leave an opening allowing contaminants to enter are not approved for use.

(6) Other methods. Any other method of connection to a well casing shall be specifically approved by the division before installation.

(7) Wells drilled in floodplains must have casing that terminates at least two feet above the maximum known floodwater elevation or when flooding is eminent, the well vent must be sealed and the well discontinued from operation until the floodwater subsides.

Auth: section 256.606 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMO (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.050 Pump Installation

PURPOSE: This rule sets specific standards as to the proper procedures for the installation of pumps for wells.

(1) Pumps and Pumping Equipment.

(A) A pump shall be constructed so that no unprotected openings into the interior of the pump or well casing exist. A hand pump, hand pump head, stand or similar device shall have a closed spout directed downward and a pump rod that operates through a stuffing box. A power driven pump shall be attached to the casing or approved suction or discharge line by a watertight connection, including flange connections, hose clamp-type connections or other flexible couplings.

(B) Priming Requirements. A pump shall be designed, installed and maintained so that priming is not required for ordinary use. Pumps installed for use only on a well water irrigation system are exempted but priming water shall be clear water, free of contamination and carrying a chlorine residual. An irrigation well equipped with a centrifugal pump may be primed without chlorination when the pump is filled with water taken directly from the well.

(C) Backflow Prevention for Chemical Injection Systems on Irrigation Wells. A chemical injection system may not be connected to a well used for human consumption.

1. Where a chemical injection system is connected directly to a well used for irrigation and which is not used as a potable water supply, a single check-spring loaded backflow prevention shall be installed between the point of chemical injection on the pump discharge piping and the water well in accordance with the manufacturer's instructions and shall have the following:

A. Valving so that water can be drained from the system to prevent freezing;

B. A vacuum relief valve to prevent back-siphoning of chemicals into the well;

C. An automatic low pressure drain at least three-quarters inch in diameter, positioned so that when draining occurs liquid will run away from the well. The automatic low pressure drain shall quickly drain the check valve body of water when operation of the irrigation pump is discontinued;

D. A watertight seal around the check valve;

E. An inspection port at least four inches in diameter to allow inspections of the inside of the check valve; and

F. The check valve shall withstand a minimum hydraulic pressure of 150 pounds per square inch (psi) without leaking. Valve shall be galvanized, epoxy coated or similar material that resists corrosion.

2. The irrigation well pump and the chemical injection pump shall be electrically or mechanically connected so that when the well pump stops, the chemical pump will shut off automatically.

(D) Temporary Pump Removal. If the pump is removed temporarily from the well for any reason, the well shall be capped with a watertight seal strong enough to prevent entry of contamination or foreign objects.

(E) Pump Bearing Lubrication. Lubrication of bearings of power driven pumps shall be with water or oil which will not adversely affect the groundwater.

1. Water lubrication. If a storage tank is required for lubrication water, it shall be designed to protect the water from contamination.

2. Oil lubrication. The reservoir shall be designed to protect the oil from contamination with a shut off valve to stop oil flow when not pumping.

(F) Electrical Installation. All electrical installations shall be performed and maintained in accordance with the existing

electric codes. A permitted well installation contractor or pump installation contractor must perform all electric wiring which impacts the operation of the pump or pumping system. This includes wiring from the pump to the control boxes to the main power supply such as the breaker box in a house. The electric wire must never be run through the pitless adapter.

(G) All plumbing or water supply distribution from the well to the point of entry hookup shall be installed and maintained in accordance with existing plumbing codes.

A permitted well installation contractor or pump installation contractor must perform all plumbing that impacts the distribution of water from its source, through the pressure system to the point of entry inside or outside of the structure or building being served. This includes, but is not limited to, pressure tanks, water treatment equipment and any other materials needed to complete the initial installation of the water system, inside and outside of the structure, except as exempted in section 256.607, RSMo.

(2) Operational domestic and multifamily wells must have a pump, either surface mounted or submersible. Wells must have a watertight seal at the top of the well to prevent contamination from entering the well from the top. Water may not be withdrawn from a drilled well by use of a well bucket that is lowered down the well for the purpose of retrieving water for human consumption or for nonhuman uses.

(3) Water Suction Lines. A water suction line shall be constructed of galvanized iron or steel, cast iron or plastic pipe as approved by the division or other material given approval by the division. Aluminum pipe is acceptable for well water irrigation systems in addition to the previously mentioned materials. When connecting metallic pipes or casing of dissimilar types, care must be taken so that electrolysis does not occur. If the pump is located next to the well with the pump suction line emerging from the top of the well, a well seal or equivalent shall be installed between the well casing and suction pipe to provide a watertight closure.

(4) Pump Discharge Lines.

(A) A buried discharge line between the well casing and the pressure tank in any installation, including a deep well turbine or a submersible pump, shall not be under negative pressure at any time. If a check valve is installed in a buried water line between the well casing and the

pressure tank, the water line between the well casing and the check valve shall meet the requirements for a suction line unless equipped with an air release valve.

(B) Pump discharge ports on irrigation wells shall be covered when not in use.

(5) Drop Pipe. The pipe used to hang the pump in a well must be composed of thermoplastic acrylonitrile-butadiene-styrene (ABS) or polyvinyl chloride (PVC) materials that have Schedule 80 (SCH 80) or thicker walls or if metallic drop pipe is used, a wall thickness of at least Schedule 40 (SCH 40) is required.

(6) Vents. All wells shall be vented with watertight caps terminating at least two feet above the regional flood level (see 10 CSR 23-3.010 (1)(A)6 for exception) or one foot above the finished grade surface or the floor of a pump room, well room, whichever is higher. The casing vent shall be a minimum one-half inch in diameter, screened and point downward. Vents may be offset provided they meet the provisions of this section. Any submersible pump shall be installed with a vented cap on the top of the well casing to prevent drawing near surface contamination into the well. When a well with a submersible pump kicks on and pumps water from the well, the drawdown of the water in the well creates a vacuum pulling air into the well. If the well is not vented properly, air will be pulled from around the drop pipe, through the electric wire hole, from around the well seal, and the like. If a well is not vented properly, it could be contaminating itself every time the pump kicks on by pulling near surface contaminants into the well.

(7) Disinfection.

(A) A new, repaired or reconditioned well or pump installation shall be thoroughly pumped to waste until the water is as clear as is reasonably possible, dependent upon groundwater conditions in the area. After that the well and pumping equipment shall be disinfected with chlorine so applied that a concentration of at least 100 parts per million (ppm) of chlorine shall be obtained in all parts of the well and plumbing system. The chlorine solution shall be introduced into the well in a manner to flush the well surfaces above the static water level with chlorine solution. A minimum contact period of two hours (overnight is better) shall be provided before pumping the well to waste and flushing the chlorine solution from the distribution system. The well owner shall be instructed by the

permittee concerning these procedures and can be responsible for pumping and flushing of the well following disinfection. A permittee shall be responsible for disinfecting the work performed on the well, pump or pumping equipment. Disinfection in a well repair operation may be accomplished at the beginning of the operation with chlorine applied to obtain a concentration of 200 parts per million (ppm) for the period of the well repair operation. The water shall be pumped to waste prior to the taking of water samples or use being made of the water. Caution: The chlorinated water must not leave the owner's property. If it does, the owner must report to the Water Pollution Control Program, Division of Environmental Quality.

(B) Special care must be exercised when replacing a pump because bacteria can easily contaminate what is pulled from the well (pump, drop pipe, electric wire) and it is difficult to disinfect the portions of the electric wire and drop pipe that are above water level. When pulling a pump the electric wire should not be allowed to touch the ground. This may be accomplished by laying plastic on the ground or utilizing a mechanical system that winds up the electric wire as it is withdrawn from the well or other appropriate means. The drop pipe should be placed on pipe racks or other precautions should be taken to keep it from contacting the ground. If contamination does occur, special care must be taken to disinfect the contaminated areas.

(C) The following table will help in determining how much chlorine to add during disinfection of the well. First you will need to determine height of the water column in well.

1. Formula to find height of water column: (total depth of well) minus (static water level) equals (height of water column). Example: (216 ft. well depth) - (37 ft. water level) = (179 ft. of water column). Then using the table find the casing size of the well, read across to the corresponding chlorine product column and use these amounts in the following formula:
2. Formula to find amount of chlorine product needed to disinfect well: (height of water column) times (amount of product from table) equals (amount of product needed to disinfect well)

Example: For a six inch casing using 5.25 percent Clorox product: $(179 \text{ ft.}) \times (0.381) = 68 \text{ oz.}$ or about one-half gallon.

(D) When placing the chlorine into the well it must be thoroughly mixed with the existing water to disperse the chlorine throughout the water column. This is best done by batch dumping large volumes of chlorinated water into the well or by placing chlorine tablets in a porous bag and lowering it and raising it within the entire water column until the chlorine is dissolved.

(E) A practical alternative is to divide the amount of needed chlorine product calculated using the Disinfection Table into liquid and tablet form. Then

1. Pour the tablets into the well, which will dissolve near the bottom of the well.
2. Pour liquid chlorine product into the well being sure to wash down all surfaces that are above the static water level.
3. Circulate water into the house by running cold water until chlorine smell is detected, turning off cold, then running hot until chlorine smell is detected, in each faucet in the house. Proper ventilation must be maintained during this step and step 5 (see paragraph (7)(E)5) to avoid overpowering potentially toxic chlorine fumes;
4. Stop circulating water and let set at least two hours (preferably overnight); and
5. Flush system by running water until no chlorine odor is detected.

Auth: section 256.606 and 256.626, RSMo (Cum. Supp. 1991). Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.060 Certification and Registration Reports

PURPOSE: This rule sets required standards for certification and registration report form submittal.

(1) The certification process involves the review of the certification report form to be sure that the well meets all construction requirements necessary for the specific area the well has been drilled. The minimum construction standards were written to protect Missouri's groundwater and to help ensure that the construction of the wells does not constitute a threat to this resource. Due to the varied quantity and quality of groundwater in Missouri, the certification number does not necessarily indicate that the well produces potable water or usable quantities of water.

(2) A certification report form, supplied by the division, shall be used to report new well construction, new pump

installation (initial pump set in newly drilled well), monitoring well construction (see 10 CSR 23-4) and heat pump well construction (see 10 CSR 23-5).

The certification report form shall be completed and submitted to the division by the permittee within 60 days after completion of any well. If the well installation contractor does not set the pump, the well installation contractor is responsible to submit a certification report form documenting work performed, otherwise the certification report form will reflect all areas of reporting.

The pump installation contractor is responsible for submitting a certification report form documenting work performed. The certification report form shall be accompanied by the certification fee. The permittee shall furnish the well owner one copy, the division one copy and retain one copy in the permittee's files. The report form shall contain all available required information. A certification report form shall be submitted for a dry hole, but no certification fee is required.

Table 1

DISINFECTION TABLE
(Produces a 100 mg/liter chlorine solution per-foot of casing size)

Casing Size Nominal diameter	Gallons of Water Per One Foot of Casing Size	Ounces of Product Added To Disinfect One (1) Foot of Water Per Casing Size		
		5.25% to 6.0% Chlorine	10% Chlorine	70% Chlorine
		PRODUCT: Chlorox, Purex, Sno-White Kandu, Topco, Action, White Magic, Surefine and MC ₂ or other brand names. (sodium hypochlorite)	PRODUCT: Liquid Bleach, Purchased from a chemical supply company (sodium hypochlorite)	PRODUCT: High-Test Calcium Hypochlorite. Purchased from a chemical company (calcium hypochlorite)
(Inches)	(Gal/Ft/Case size)	(Fluid Ounces)	(Fluid Ounces)	(Dry Ounces)
1.25	0.06	0.015	0.008	0.0011
1.50	0.09	0.023	0.012	0.0017
2	0.16	0.041	0.021	0.0031
2.5	0.25	0.064	0.033	0.0048
3	0.37	0.094	0.049	0.0071
3.5	0.50	0.127	0.067	0.0095
4	0.65	0.165	0.087	0.0124
5	1.02	0.259	0.136	0.0194
6	1.50	0.381	0.200	0.0286
8	2.60	0.660	0.347	0.0495
10	4.08	1.036	0.544	0.0777
12	5.87	1.490	0.782	0.1118
14	8.00	2.031	1.066	0.1523
16	10.44	2.650	1.391	0.1988
18	13.21	3.354	1.761	0.2515
24	23.50	5.966	3.132	0.4474
	36.70	9.317	4.891	0.6988

(3) The registration process involves the documentation of certain types of activities according to the requirements and reported on forms supplied by the division.

(4) A registration report form, supplied by the division, shall be used to report plugging of wells, raising of casing, lining of wells, drilling of jetted wells (unless exempted), deepening of wells, major repairs and alteration of wells and must be submitted to the division by the permittee within 60 days after completion of the appropriate operations. Records for replacement pumps will not be required unless requested by the division. Pump replacement cannot change status of the well from domestic to multifamily or from domestic to high yield. The registration report form shall be accompanied by the registration fee, if required. The permittee shall furnish the well owner one copy, the division one copy and retain one copy in the permittee's files. The report form shall contain all available required information.

(5) Certification report forms and Registration report forms submitted for well construction, well reconstruction, new pump installation, monitoring well construction (see 10 CSR 23-4), heat pump well construction (see 10 CSR 23-5), and test hole (see 10 CSR 23-6) shall include the geographic location of the well, boring or test hole. The geographic location shall have a format in degrees, minutes and seconds for latitude and longitude relative to the North American Datum 1983 (NAD83) geodetic datum. Location accuracy shall be at least one place after the seconds decimal point: i.e., latitude 38°59'59.9"N, longitude 94°01'01.0"W.

(6) If work is performed by the landowner, following strict requirements under section 256.607 RSMo, the landowner must submit all required forms and fees and is subject to all laws and regulations as if a permitted entity.

*Auth: section 256.606, 256.614, 256.623 and 256.626, RSMo Supp. 1991. *Original rule filed April 2, 1987, effective July 27, 1987. Emergency recission and emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Rescinded and readopted: Filed Aug. 17, 1993 effective March 10, 1994. Amended: Filed March 30, 2005 Effective: Oct. 30, 2005. *Original authority: 256.606, RSMo 1991 and 256.614, 256.623 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-3.070 Plastic Well Casing

PURPOSE: This rule designates special standards for the use of plastic casing in wells that produce water.

(1) Standards.

(A) Approved Materials. Any thermo-plastic pipe used for well casing shall meet the standards of the American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103, which are referenced as ASTM F480 Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH40 and SCH80. Acceptable casings used for wells that produce potable water must be composed of certain classes of polyvinyl chloride (PVC) or acrylonitrile-butadiene-styrene (ABS) thermoplastics accepted by ASTM for well casings. Other casing may be approved if advance written approval is obtained by the division.

(B) Standard dimension ratio (SDR) is determined by the following (outside diameter divided by wall thickness equals SDR). Casing must have SDR ratings of SDR 26, SDR 21, SDR 17 or SDR 13.5 to be acceptable for usage. Schedule 40 (SCH 40) is the most commonly used casing for wells producing potable water and is acceptable.

(C) A minimal nominal casing size for domestic wells is 6 inches in diameter (average actual size is 6.625 inches).

(D) The thermoplastic well casing must have the following markings displayed on the casing according to ASTM standards. If a casing does not have these markings, it is not permitted for use unless given advance written approval by the division.

(E) Well casing may be joined by solvent weld, mechanical joints such as splined couplings, threaded or other types of joints approved in advance by the division. All joints must be watertight. Solvent welded joints are not permitted for monitoring wells.

(2) Storage, Handling and Components. The installer

(A) Shall store pipe in such a manner to prevent sagging or bending;

(B) Shall inspect pipe and couplings carefully for cuts, gouges, deep scratches, damaged ends and other major imperfections and shall not use any plastic pipe or coupling which has these defects or imperfections;

(C) Shall use solvent cement meeting the requirements of the specifications for the particular plastic used. The cement used shall provide sufficient open time for making good joints but the installer shall complete joints immediately upon applying the solvent cement;

(D) Shall use only pipe and coupling combinations that give close and satisfactory interference fits which will readily mate when the solvent cement is applied and the pieces are joined. The pipe shall enter the socket to between two-thirds and full depth of the socket depth when inserted and turned;

(E) May use plastic pipe coupling with molded or formed threads but must use only the thread lubricant which is suitable for the particular type of plastic being used and the lubricant must not be a source of contamination to the water; and

(F) Shall use a coupling appropriate for the specific transition when connecting plastic pipe to a non-plastic well screen.

(3) Technique for Joining Solvent Weld Plastic Well Casing.

(A) Cutting. The installer shall use fine-tooth blades with little or no set for when cutting the pipe is necessary. Pipe ends shall be cut square. A plastic pipe cutter equipped with extra-wide rollers and thin cutting wheels may be used. Standard steel pipe or tubing cutters shall not be used for cutting plastic pipe.

(B) Cleaning. The installer shall clean all dirt, dust, moisture and burrs from pipe ends and couplings. The installer may use only chemical or mechanical cleaners which are suitable for the particular plastic material being used.

EXAMPLE

1	2	3	4	5	6	7	8	9
ABCPLASTICS	6"	Well Casing	PVC1120	SDR21	C-1	F-480	SF-WC	C9APIE4

1. Manufacturer's name or trademark.
2. Nominal Casing Size. Must be six inches (6") or larger.
3. Intended application for product. Must state "Well Casing" to be used as casing.
4. Type of material. Must be PVC or ABS material.
5. SDR - Standard Dimension Ratio. Must be SDR 26, SDR 21, SDR 17, SDR 13.5 or SCH40.
6. Impact Classification. Must have IC-0, IC-1, IC-2 or IC-3.
7. ASTM Specification Number. Must have F-480 = Standard for Plastic Well Casing.
8. National Sanitation Foundation Logo. Must have NSF-WC = Well Casing. This is an independent laboratory's seal of approval.
9. Manufacturer's Code Number.

(C) Primer. The installer shall use a primer when, because of the type of plastic material being used, the pipe and coupling surfaces must be softened and dissolved in order to form a continuous bond between the mating surfaces or when the particular type of solvent cement being used requires one, or both.

(D) Cement Application. The installer shall apply a moderate and even coat of cement to the inside of the coupling to cover the distance of the joining surface only. The installer shall then quickly apply an even coat of cement to the outside of the pipe being joined to a distance which is equal to the depth of the pipe coupling socket. Caution should be used when handling solvent cement to avoid skin contact or inhalation of vapors.

(E) Assembly. The installer shall

1. Make the joint as quickly as possible after application of the cement, and before it dries;
2. Reapply cement before assembling if the cement dries partially;
3. Insert the pipe into the coupling socket, turning the pipe to ensure even distribution of cement;
4. Make sure that the pipe is inserted to the full depth of the coupling socket;
5. Remove excess solvent cement from the exterior of the joint with a clean, dry cloth;
6. Tighten a threaded joint by no more than one full turn using a strap wrench;
7. Not disturb the coupling joint until after the cement has set, in order to avoid damage to the joint and loss of fit; and
8. Allow sufficient time for the joint to develop good handling strength based on manufacturer's specifications (usually two to seven minutes). When temperatures exceed 100 degrees Fahrenheit, difficulty in proper bonding may be experienced because the active solvent agent evaporates too rapidly. The ends of the casing to be joined should be cooled below 100 degrees Fahrenheit before they can be solvent cemented. Keeping casing in the shade will help.

When temperatures fall below 40 degrees Fahrenheit, the use of specially formulated cements may be advisable to ensure optimum strength development.

(F) Drilling Inside of Plastic Casing. An installer should use extreme care if drilling inside the plastic casing is required when drilling any kind of well because the drilling process can fracture or abrade the plastic casing.

(G) Grouting of Plastic Casing.

1. Rapid-setting cement is not to be used. Because of its high heat of hydration, grout made of rapid-setting cement is not permitted for use in wells which are cased with PVC or ABS pipe. The following shows the strength of PVC at various temperatures based on 73.4 degrees Fahrenheit being 100 percent of its test strength:

- | | |
|----|-------------------------------------|
| A. | 50 degrees Fahrenheit, 114 percent; |
| B. | 60 degrees Fahrenheit, 107 percent; |
| C. | 70 degrees Fahrenheit, 101 percent; |
| D. | 80 degrees Fahrenheit, 95 percent; |
| E. | 90 degrees Fahrenheit, 88 percent; |
| F. | 100 degrees Fahrenheit, 83 percent; |
| G. | 110 degrees Fahrenheit, 77 percent; |
| H. | 120 degrees Fahrenheit, 72 percent; |
| I. | 130 degrees Fahrenheit, 65 percent; |
| J. | 140 degrees Fahrenheit, 40 percent; |
| | and |
| K. | 150 degrees Fahrenheit, 10 percent. |

2. Bentonite and bentonite slurry grout is encouraged. The use of chip bentonite or bentonite slurry grout is encouraged when grouting the annulus of wells using plastic casing because these grouts do not increase in temperature during the curing process.

3. Cement slurry is usable with some restrictions. The use of neat cement slurry can cause problems in certain situations. During the curing process of neat cement slurry temperature increases are a by-product. In a typical well with two inch annulus, temperature increases in the range of 17 degrees to 35 degrees are normal. When annular spaces are larger resulting in thicker grout, the temperature increase that results may cause the casing to fail. The addition of two to nine percent bentonite powder to the cement slurry will reduce the

rate at which heat is generated allowing the heat to be dissipated, resulting in less potential damage to the casing. If cement slurry is used, it is recommended that bentonite be added or that cold water be circulated in the casing while the grout is curing. Maximum grout hydration temperatures in wells with annular spaces less than five inches are reached between seven and 10 hours after mixing.

(H) Cavernous Rock Walls. As a general rule, plastic well casing is not recommended to be used as a casing in wells cased and grouted through cavernous rock formations. However, in these cases, plastic casing will work. This determination will be made by the well installation contractor.

(I) Use of Screws. When extra strength is desired in solvent weld joints, stainless steel screws may be used, but must not penetrate through to the inside of the casing. The use of any type of rivets that penetrate to the inside of the casing is prohibited.

(J) Screws Required on Unconsolidated Material Irrigation Wells. When PVC or ABS casing is used that requires gluing, at least four stainless steel screws must be used in each coupling. The screws shall not penetrate through to the inside of the casing.

(K) PVC and ABS casing may never be used when known gasoline or solvent contamination exists within 100 yards of the well being repaired or drilled. When gasoline or solvent contamination levels do not present a potential threat to the integrity of the casing, the PVC or ABS pipe material will be considered on a case by case basis.
Approval must be received in advance.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMO (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.080 Liners

PURPOSE: This rule sets guidelines for the use of liners in wells in Missouri.

(1) Use of Liners. Liners are generally used for three purposes. They are used to

(A) Hold the well bore open when caving or spalling rock is encountered. These liners are usually slotted to allow water to enter the well from the aquifer; or

(B) Seal out problem areas below the existing casing or to correct inadequate grouting seals of the casing annulus and other problems arising concerning contamination of subsurface waters. Plastic liners may be used effectively to solve iron bacteria problems on steel casings. If a plastic liner is installed to seal out an iron bacteria problem, it must extend from the bottom of the steel casing and must have its upper end no deeper than 10 feet below the top of the well casing. The liner must also be grouted as stated in subsection (3)(B) or this rule; or

(C) If the liner is just used to solve a rust problem in the casing, a packer must be placed within 5 feet of the bottom of the rusted casing interval. The liner must extend from the bottom of the steel casing to a point less than 10 feet from the surface. The packer must be inside the casing and no grout is required.

(2) General Specifications and Guidelines.

(A) Liners may be composed of either steel or thermoplastic.

1. Steel liners must be new and have an inside diameter at least four inches and have a minimum wall thickness not less than .188 inches.

2. Plastic liners must meet American Society for Testing and Materials (ASTM) standards concerning thermoplastic well casing and be composed of polyvinyl (PVC) or acrylonitrile-butadiene-styrene (ABS) materials formulated for well casing.

A. The inside diameter must not be smaller than four inches.

B. The Standard Dimension Ratio (SDR) ratings allowable for liner is SDR 26, SDR 21, SDR 17 and SDR 13.5. Schedule ratings allowable are SCH 40 and SCH 80.

(B) All liners used to seal out potential groundwater contamination areas below the existing casing or to correct inadequate grouting seals of the casing annulus and other problems arising concerning the contamination of subsurface water must have their upper end set no deeper 10 feet below the top of the well casing. The liner must be secured in the hole.

(C) Packers shall be secured on plastic liners with screws (making sure they do not penetrate the liner) or other methods and on steel liners the packer shall be welded or mechanically attached so that it will not move during liner placement. Packers are not required on liners used only to hold open the well bore.

(D) Whenever a liner is needed it is recommended that the bottom of the liner be at the bottom of the well.
This will help prevent potential future problems with pump replacement.

(3) Method of Installation.

(A) When liners are used only to hold open the well bore they may be placed in the well following normal industry installation procedures.

(B) All other liners must be sealed into place following these procedures:

1. The liner must have a rubber packer (first packer) secured near the bottom of the interval to be grouted. Another rubber packer (the second packer) must be secured about 20 feet above the first packer. This will result in two rubber packers spaced about 20 feet apart on the liner. These packers must hold the grout in place. Grout must be placed between the first and second packer and completely fill this interval as the liner is being installed into the casing. Grout must also be placed on top of the second packer filling it to at least a point 40 feet above the second packer or two packers must be placed close together near the bottom of the liner and grouted after the liner is set by pressure grouting through a tremie pipe. The bottom

60 feet of annulus created when installing a 4 1/2 inch or 5 inch outside diameter liner must be grouted. If a liner must be grouted, a minimum annulus of one-half inch must be present. Table 5 and 6 state the required amount of grout to fill the annulus 60 feet. Care must be taken by the well installation contractor when selecting the type of grout used, keeping in mind the time of liner installation and grout set-up time. The liner shall be placed into the well casing being careful not to damage the packers or liner; *

2. Alternate grouting procedures will be considered on a case-by-case basis. Written approval in advance by the division is required.

- (4) Permittee Responsibility to Seal Liner. In wells that have a liner used for any purpose, other than holding the well bore open, it is the responsibility of the permittee to ensure that the annulus between the well bore and the liner is sealed.

- (5) PVC and ABS liners may never be used when known gasoline or solvent contamination exists within one hundred (100) yards of the well being repaired or drilled. When gasoline or solvent contamination levels do not present a potential threat to the integrity of the pipe or liner, the use of PVC or ABS pipe material will be considered on a case by case basis. Approval must be received in advance.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Emergency rescission and emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Rescinded and readopted: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

Table 5

Number of Bags for Minimum Amount of Required Grout for Lining Water Wells

Outer Diameter of Plastic Liner: 4 1/2 inches Minimum Length of Grout: 60 feet

Borehole Diameter	6		8		10	
	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.
Type of Grout						
<u>CEMENT</u>						
Portland Type I	5	11	13	19	24	30
Portland Type III	5	11	13	19	24	30
BENTONITE						
Pellets—						
1/2" Baroid Pellets	7	16	19	29	36	45
3/8" Baroid Pellets	7	17	21	30	37	47
1/4" Baroid Pellets	7	17	20	30	37	47
Wyo-Bend Tablets	8	18	22	32	39	49
Volclay 1/2"	8	18	22	32	40	50
Volclay 3/8"	8	19	23	33	41	52
Volclay 1/4"	8	19	23	34	42	53
Chips—						
Baroid Hole Plug	7	17	21	30	38	47
Wyo-bend Coarse	6	14	17	25	32	40
Wyo-bend Medium	6	15	18	26	33	41
Volclay Coarse	7	16	19	28	35	44
Volclay Medium	7	16	20	29	36	45
Granular—						
Benseal	6	15	18	26	33	41
Wyo-bend No. 8	6	14	17	25	32	40
Wyo-bend No. 16	6	14	17	25	32	40
Slurry—						
Baroid	2	3	4	6	8	10
Wyo-bend	2	4	4	7	8	10
Volclay	1	3	4	6	7	9

*Ann. = Bags needed to fill Annular Space

**O.H. = Bags needed to fill the Open Bore Hole

10 CSR 23-3.090 Regionalization

PURPOSE: This rule sets specific additional standards for certain regions in Missouri.

(1) **Area 1.** All persons engaged in drilling domestic wells in Area 1, a limestone or dolomite area (Figure 1 and 8) shall

(A) Set no less than 80 feet of casing, extending not less than 30 feet into bedrock. Example: if 60 feet of residual (weathered rock) material is encountered in drilling before bedrock, then 90 feet of casing must be set;

(B) Construct the drill hole a minimum of 8 5/8 inches in diameter to the surface casing point;

Table 6

Number of Bags for Minimum Amount of Required Grout for Lining Water Wells

Outer Diameter of Plastic Liner: 5 inches **Minimum Length of Grout: 60 feet**

Borehole Diameter	6		8		10	
	*Ann.	**O.H.	*Ann.	**O.H.	*Ann.	**O.H.
Type of Grout						
<u>CEMENT</u>						
Portland Type I	3	11	12	19	23	30
Portland Type III	3	11	12	19	23	30
BENTONITE						
Pellets—						
1/2" Baroid Pellets	5	16	18	29	34	45
3/8" Baroid Pellets	5	17	19	30	35	47
1/4" Baroid Pellets	5	17	18	30	35	47
Wyo-Bend Tablets	6	18	19	32	37	49
Volclay 1/2"	6	18	20	32	38	50
Volclay 3/8"	6	19	20	33	39	52
Volclay 1/4"	6	19	21	34	40	53
Chips—						
Baroid Hole Plug	5	17	19	30	36	47
Wyo-bend Coarse	5	14	16	25	30	40
Wyo-bend Medium	5	15	16	26	31	41
Volclay Coarse	5	16	17	28	33	44
Volclay Medium	5	16	18	29	34	45
Granular—						
Benseal	5	15	16	26	31	41
Wyo-bend No. 8	5	14	16	25	30	40
Wyo-bend No. 16	5	14	16	25	30	40
Slurry—						
Baroid	1	3	4	6	7	10
Wyo-bend	1	4	4	7	8	10
Volclay	1	3	4	6	7	9

*Ann. = Bags needed to fill Annular Space

**O.H. = Bags needed to fill the Open Bore Hole

(C) Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic).

(D) Install and seal casing as follows:

1. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials.

Drill cuttings may be placed above the grouted interval to fill in the annular space

A. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

B. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

C. The following times must be followed for curing grout when no packer is used:

(I) Hi-early cement - minimum set time of 12 hours,

(II) Portland Type I cement - minimum set time of 72 hours,

(III) Chipped bentonite - minimum hydration time of four hours; and

(IV) High solids bentonite slurry - varies based on additives and manufacturer's specifications;

(E) If the well is to be drilled as an alluvial well

1. No less than 20 feet of casing shall be set above the screened or perforated interval of the well;

2. The drill hole shall be constructed a minimum of 10 5/8 inches in diameter being at least 4 inches larger in diameter than the casing to be placed into it. Well casing must be at least six inch nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural gravels in the formation being drilled can be allowed to cave back against the screen;

3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper 20 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(2) **Area 2.** All persons engaged in drilling domestic wells in Area 2, Central Western Missouri (Figure 2) shall

(A) Set no less than 40 feet of casing, extending not less than 15 feet into bedrock. Areas where Cherokee Group sediments are present; set casing through caving zones and into water bearing sands. In some instances this might require several hundred feet of casing. Liners may be used with minimum amount of casing listed for this area;

(B) Construct the drill hole a minimum of 8 5/8 inches in diameter to the surface casing point;

(C) Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic).

(D) Install and seal casing as follows: Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above the grouted interval to fill in the annular space

1. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

2. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

3. The following times must be followed for curing grout when no packer is used:

A. Hi-early cement - minimum set time of 12 hours;

B. Portland Type I cement - minimum set time of 72 hours;

C. Chipped bentonite - minimum hydration time of four hours;

D. High solids bentonite slurry - varies based on additives and manufacturer's specifications.

(E) In areas where shale or shaley material is present above the water-bearing zones, casing or liner shall be set so as to exclude intervals which would cave into the drillhole or cause muddy water to be pumped.

(F) If the well is to be drilled as an alluvial well

1. No less than 20 feet of casing shall be set above the screened or perforated interval of the well;

2. The drill hole shall be constructed a minimum of 10 5/8 inches in diameter being at least 4 inches larger in diameter than the casing to be placed into it. Well casing must be at least 6 inch nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural gravels in the formation being drilled can be allowed to cave back against the screen; and

3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper 20 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(G) Five inch casing wells. A well may be completed using a 5 inch nominal casing if the following standards are met:

1. The casing must be set full length and be slotted across the producing horizons;

2. The drill hole must be 8 5/8 inches in diameter with the upper 40 feet to be reamed out to 10 5/8 inches in diameter; and

3. The upper 40 feet of annular space must be grouted and the remainder of the borehole below the grout must be gravel packed.

(3) **Area 3.** All persons engaged in drilling domestic wells in area 3, northwest Missouri area, (Figure 3) shall

(A) If the well is to be drilled as a glacial drift or alluvial well;

1. No less than 20 feet of casing shall be set above the screened or perforated interval of the well;

2. The drill hole shall be constructed a minimum of 10 5/8 inches in diameter being at least 4 inches larger in diameter than the casing to be placed into it. Well casing must be at least 6 inch nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural (native) gravels in the formation being drilled can be allowed to cave back against the screen;

3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper 20 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(B) If the well is to be drilled as a bedrock well

1. Set no less than 40 feet of casing, extending not less than 15 feet into bedrock;

2. Construct the drillhole a minimum of 8 5/8 inches in diameter to the surface casing point;

3. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic); and

4. Install and seal casing as follows:

A. Full-length grout is preferred and will ensure a better annular seal, but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cutting used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space-

(I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

(II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

(III) The following times must be followed for curing grout when no packer is used:

(a) Hi-early cement -
minimum set time of
12 hours;

(b) Portland Type I cement - minimum set time of 72 hours;

(c) Chipped bentonite - minimum hydration time of four hours;

(d) High solids bentonite slurry - varies based on additives and manufacturer's specifications; and

(C) If usable amounts of water are not expected to be available in deeper bedrock horizons and water is only available from the upper, fractured and weathered portion of bedrock, and if the water is coming from a zone that is at least 40 feet deep, you must set a minimum of 40 feet of casing but only 1 foot of this casing need be set into the bedrock. This allows the use of shallower water horizons under some circumstances; and

(D) Five-Inch Casing Wells. A well may be completed using a five inch nominal casing if the following standards are met:

1. The casing must be set full-length and be slotted across the producing horizons;
2. The drillhole must be 8 5/8 inches in diameter with the upper 40 feet to be reamed out to 10 5/8 inches in diameter; and
3. The upper 40 feet of annular space must be grouted and the remainder of the borehole below the grout must be gravel packed.

(4) **Area 4.** All persons engaged in drilling domestic wells in Area 4, northeast Missouri area, (Figure 7) shall

(A) If the well is to be drilled as a bedrock well

1. Set no less than 40 feet of casing, extending not less than 15 feet into bedrock;
2. Construct the drill hole a minimum of 8 5/8 inches in diameter to the surface casing point;
3. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic); and
4. Install and seal casing as follows:

A. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space

(I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

(II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

(III) The following times must be followed for curing grout when no packer is used:

(a) Hi-early cement - minimum set time of 12 hours;

(b) Portland Type I cement - minimum set time of 72 hours;

(c) Chipped bentonite - minimum hydration time of four hours; and

(d) High solids bentonite slurry - varies based on additives and manufacturer's specifications;

(B) If the well is to be drilled as an unconsolidated materials well

1. No less than 20 feet of casing shall be set above the screened or perforated interval of the well;

2. The drill hole shall be constructed a minimum of 10 5/8 inches in diameter being at least 4 inches larger in diameter than the casing to be placed into it. Well casing must be at least 6 inch nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural (native) gravels in the formation being drilled can be allowed to cave back against the screen; and

3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper 20 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(C) If usable amounts of water or water of acceptable quality are not expected to be available in deeper bedrock horizons and water is only available from the upper, fractured and weathered portion of bedrock, and if the water is coming from a zone that is at least 40 feet deep, a minimum of 40 feet of casing must be set but only 1 foot of this casing need be set into the bedrock. This allows the use of shallower water horizons under some circumstances.

(5) **Area 5.** All persons engaged in drilling domestic wells in Area 5, Missouri Bootheel and all major stream alluvial areas (Figure 5) shall

(A) If the well is to be drilled as a bedrock well

1. Set no less than 80 feet of casing, extending not less than 30 feet into bedrock;

2. Construct the drill hole a minimum of 8 5/8 inches in diameter to the surface casing point;

3. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.030 is required.

4. Install and seal casing as follows:

A. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials.

Drill cuttings may be placed above grouted interval to fill in the annular space;

(I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

(II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

(III) The following times must be followed for curing grout when no packer is used:

(a) Hi-early cement - minimum set time of 12 hours;

(b) Portland Type I cement - minimum set time of 72 hours;

(c) Chipped bentonite - minimum hydration time of four hours; and

(d) High solids bentonite slurry - varies based on additives and manufacturer's specifications;

(B) If the well is to be drilled as an unconsolidated materials well

1. No less than 20 feet of casing shall be set above the screened or perforated interval of the well;

2. The drill hole shall be constructed a minimum of 4 inches larger than the casing to be placed into it. Well casing must be at least 4 inch nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural (native) gravels in the formation being drilled can be allowed to cave back against the screen; and

3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper 20 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(C) Shallow unconsolidated wells located in Area 5, the Missouri Bootheel (Figure 8) and all major stream alluvial areas may be exempted from this rule. If the wells and drillers of the wells meet the following specifications they are exempted:

1. Wells are drilled, jetted, driven, washed or constructed in other ways;
2. Wells are constructed in unconsolidated materials; and
3. Well casing diameters are no larger than 2 inches.

(6) **Area 6.** All persons engaged in drilling domestic wells in Area 6, St. Francois Mountain area (Figure 6) shall

(A) Where granite or igneous rock is within 100 feet below the surface, set not less than 40 feet of casing extending not less than 15 feet into bedrock

1. Construct the drillhole a minimum of 8 5/8 inches in diameter to the surface casing point;
2. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);
3. Install and seal casing as follows:
 - A. Full-length grout is preferred and will ensure a better annular seal, but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above the grouted interval to fill in the annular space;

(I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

(II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

(III) The following times must be followed for curing grout when no packer is used:

(a) Hi-early cement - minimum set time of 12 hours;

(b) Portland Type I cement - minimum set time of 72 hours;

(c) Chipped bentonite - minimum hydration time of four hours; and

(d) High solids bentonite slurry - varies based on additives and manufacturer's specifications.

(B) In areas where granite is more than 100 feet below the surface, set not less than 80 feet of casing not less than 30 feet into bedrock.

1. Construct the drillhole a minimum of 8 5/8 inches in diameter to the surface casing point.
2. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

3. Install and seal casing as follows:

A. Full-length grout is preferred and will ensure a better annular seal, but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10CSR23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space;

(I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

(II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

(III) The following times must be followed for curing grout when no packer is used:

(a) Hi-early cement
- minimum set time of 12 hours;

(b) Portland Type I cement -
minimum set time of 72 hours;

(c) Chipped bentonite -
minimum hydration time of four hours; and

(d) High solids bentonite slurry - varies based on additives and manufacturer's specifications.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Amended: Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Filed: Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.100 Sensitive Areas

PURPOSE: This rule sets specific additional standards for sensitive areas shown on the map that have been designated on the basis of either naturally occurring problems caused by unique groundwater chemistry or because they are located in a fragile groundwater environment which is experiencing rapid population growth or urbanization.

(1) **Sensitive Area A.** All persons engaged in drilling wells in this area (Figure 8) and encounter Pennsylvanian shales and/or sandstones shall

(A) Set no less than 80 feet of casing extending not less than 30 feet into bedrock where Pennsylvanian shale and sandstone are not present and no less than 150 feet of casing extending not less than 30 feet into bedrock where the Pennsylvanian shale and sandstone are present;

(B) Construct the drillhole a minimum of 8 5/8 inches in diameter to the surface casing point;

(C) Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

(D) Install and seal casing as follows:

1. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space-

A. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes; and

B. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

2. The following times must be followed for curing grout when no packer is used:

A. Hi-early cement - minimum set time of 12 hours;

B. Portland Type I cement - minimum set time of 72 hours;

C. Chipped bentonite - minimum hydration time of four hours; and

D. High solids bentonite slurry - varies based on additives and manufacturer's specifications.

(2) **Sensitive Area B.** Wells drilled within 1/4 mile of the major lakes in Missouri (Figure 8) (see list of lakes) must be cased so that they do not produce lake water into their wells. Wells drilled within 1/4 mile of the major lakes that are not drilled below normal pool level of the lake are not required to meet sensitive Area B requirements. These wells must be constructed to Area 1 requirements stated in 10 CSR 23-3.090 (1).

The following specifications shall be followed:

(A) List of Lakes

1. Truman;
2. Stockton;
3. Table Rock;
4. Bull Shoals;
5. Lake of the Ozarks;
6. Wappapello;
7. Pomme de Terre;
8. Norfolk; and
9. Clearwater.

(B) If the well is to be drilled closer than 1/4 mile to the shoreline of the lake, casing must be set to a point 50 feet below the bottom of the lake. The deepest part of the lake within 1/4 mile radius from the well location shall be used in this determination. Example: if the drill site is located 1,000 feet from the lake, is located 50 feet higher in elevation than the shoreline and the deepest estimated bottom of the lake within 1/4 mile radius from the well is 30 feet deep, then 130 feet of casing must be set. 50 feet (elevation above lake)+30 feet (depth of water)+50 feet (below lake bottom)= 130 feet casing;

(C) It is highly recommended that before a well is drilled that is located closer than 1/4 mile to the shoreline of any major lake, a casing point request form (supplied by the division) be submitted to the division. The casing point request form will be used to establish the required amount of casing and will supply information on requested water yield amounts and corresponding total depth of well. To ensure the location of the proposed drill site a copy of the landowner's property deed showing detailed location information and a copy of the landowner's plat (if available) showing proposed drilling site location must be attached to completed casing point request form. The casing point request form will be processed quickly and returned to the landowner, driller or both. After the well is drilled the casing point request form must be submitted with the certification form. If a well is drilled within 1/4 mile of one of the lakes contained in section (2) and less than the required amount of casing is set, the well installation contractor must bring the well up to the standards set in this rule and will be subject to disciplinary action deemed necessary by the division;

(D) A minimum of 80 feet of casing must be set;

(E) The drillhole shall be constructed a minimum of 8 5/8 inches in diameter to the surface casing point;

(F) The new steel or plastic casing shall be installed as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

(G) The casing shall be installed and sealed as follows:

1. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space;

A. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

B. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

C. The following times must be followed for curing grout when no packer is used:

(I) Hi-early cement - minimum set time of 12 hours;

(II) Portland Type I cement - minimum set time of 72 hours;

(III) Chipped bentonite - minimum hydration time of four hours; and

(IV) High solids bentonite slurry - varies based on additives and manufacturer's specifications; and

(H) In areas that have water quality problems that would be aggravated by the use of steel casing, plastic casing is recommended. If it is necessary to set steel casing due to geologic reasons, the following may substitute for casing:

1. Set no less than 80 feet of casing; and

2. Liner must be set through the casing to the point as determined in subsection (1)(C). Example: if the casing point was determined to be 180 feet, then 180 feet of liner must be set. The liner must meet all requirements as stated in 10 CSR 23-3.080, including grouting.

(3) **Sensitive Area C.** The Springfield area is one in which urbanization is occurring at a rapid rate in an extremely sensitive and fragile geologic and hydrologic setting. The area is underlain by fractured, and

cavernous limestone and pollutants are able to migrate quickly, both vertically and horizontally. Because of these factors, it is necessary to treat this area differently than surrounding areas and have stricter well construction standards. All persons engaged in drilling of wells in the sensitive area C (Figure 8) shall

(A) The casing shall be set as determined by Area C casing depth map. When drilling in Sensitive Area C, it is strongly recommended that a casing point request be submitted so that the exact amount of casing can be set, limiting the amount of grout required. Approval must be obtained before drilling begins. Area C casing depth map sets the minimum amount of required casing that will extend at least 10 feet below the Northview Shale. Due to surface elevation changes within the quarter (1/4) section (one-quarter (1/4) mile), the amount of casing stated on the casing depth map may extend more than 10 feet below the bottom of the Northview Shale. In those instances, where the casing extends more than 10 feet below the bottom of the Northview Shale, more than 30 feet of grout is required to seal off the Northview Shale. See 10 CSR 23-3.100(3)(D);

(B) The drill hole shall be constructed a minimum of 8 5/8 inches in diameter to the surface casing point;

(C) New steel or plastic casing shall be installed as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

(D) Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required if the casing does not go more than 10 feet below the bottom of the Northview Shale. Due to surface elevation changes within the quarter (1/4) section (1/4 mile) the amount of casing required is calculated at the highest elevation. Therefore, if a well is drilled in a lower elevation area the required casing will go more than 10 feet below the bottom of the Northview Shale. In many cases 30 feet of grout will not seal off the Northview Shale since the bottom of the casing is much deeper. The Northview Shale interval must be grouted from 10 feet below to the top of the shale regardless of the amount of casing set. A minimum of 30 feet of grout is required. Drill cuttings and a drive shoe or drill

cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space. Install and seal casing as follows:

1. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

2. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

3. The following times must be followed for curing grout when no packer is used:

A. Hi-early cement-minimum set time of 12 hours;

B. Portland Type I cement - minimum set time of 72 hours;

C. Chipped bentonite-minimum hydration time of four hours; and

D. High solids bentonite slurry - varies based on additives and manufacturer's specifications; and

(E) In areas that have water quality problems that would be aggravated by the use of steel casing, plastic casing is recommended. If it is necessary to set steel casing due to geologic reasons, the following may substitute for casing:

1. No less than 100 feet of casing shall be set. The drill hole shall be constructed a minimum of 8 5/8 inches in diameter and new 6 inch inside diameter steel casing shall be installed as specified in 10 CSR 23-3.030. A 6 inch hole is then drilled to total depth and a plastic liner having an outside diameter no greater than 4 1/2 inches shall be secured into place. No variances will be issued for this requirement; and

2. Liner must be set through the casing to the required casing point. The liner must be set to the casing depth as determined by Area C casing depth map. The liner must

meet all requirements as stated in 10 CSR 23.3.080 concerning liners, including grouting. More than 60 feet of grout may be required as stated in 10 CSR 23-3.100 (3)(D).

(4) **Special Area 1.** Due to the unique and varied geological conditions present because the bedrock is deeply weathered and often highly fractured, openings filled with mud may extend deep into the bedrock. Caving-in of the hole during drilling and after well construction is a problem. The following rules are the minimum that are required but in many cases much more steel casing may be necessary to secure the well bore. Also, in some cases plastic liner is not strong enough to hold the well bore open and steel should be used. All persons engaged in drilling of wells in special area 1 (see Figure 1 and Figure 7 included herein) shall-

(A) Set no less than 80 feet of casing. The hole shall be cased 15 feet below residuum, broken rock or mud pockets into solid bedrock or if rock is not encountered within 150 feet consult the division for further instructions concerning a variance, unless casing will be set into deeper bedrock;

(B) Construct the drill hole a minimum of 8 5/8 inches in diameter to the surface casing point;

(C) Install new steel casing as specified in 10 CSR 23-3.030. Plastic casing of any type will not be allowed in this area; and

(D) Install and seal casing as follows:

1. Full-length grout is highly recommended and will ensure a better annular seal but sealing the lowermost 30 feet of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings with a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space;

2. A drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

A. The following times must be followed for curing grout when no packer is used:

(I) Hi-early cement - minimum set time of 12 hours;

(II) Portland Type I cement - minimum set time of 72 hours;

(III) Chipped bentonite - minimum hydration time of four hours;

(IV) High solids bentonite slurry - varies based on additives and manufacturer's specifications; and

3. If drilling conditions do not permit a bottom seal, then the casing must be driven and grouting material introduced around the outside of the casing while the casing is being driven. If the casing can not be sealed to prevent surface contamination from entering the well a liner must be set and sealed according to 10 CSR 23-3.080.

(E) In areas where poor drilling conditions exist and it is necessary to drive multiple strings of smaller diameter casing through the surface casing, each succeeding liner should extend into the preceding liner or casing at least 20 feet and the annulus created between the casing and liner must be grouted.

(F) In wells where it is necessary to set casing below static water levels, it may be advisable to set plastic liner as stated in 10 CSR 23-3.080 from the surface to a point below the pumping water level to avoid excessive iron in the produced well water.

(5) **Special Area 2 Definitions.**

(A) **"Lower aquifer"** means that portion of transmissive, water-bearing geologic material extending from the Cotter Dolomite to igneous bedrock. The lower aquifer includes all formations constituting the Ozark Aquifer and the St. Francois Aquifer in the southwestern portion of the state.

(B) **"Low-permeability bedrock"** means that portion of geologic material between the lower aquifer and upper aquifer that does not readily transmit water in sufficient quantities to supply a

well. The Northview Formation, the Chattanooga Shale, and the upper 30 feet of the Cotter Dolomite shall constitute the low-permeability bedrock. The low-permeability bedrock serves as a natural barrier to groundwater mixing between the upper aquifer and lower aquifer. See Figure 7A included herein for an illustration of geology in Special Area 2.

(C) **“Upper aquifer”** means that portion of the transmissive, water-bearing geologic material above the top of the low-permeability bedrock. The upper aquifer includes all formations constituting the Springfield Plateau Aquifer in the southwestern portion of the state.

(D) **“Maximum contaminant level (MCL)”** is the maximum permissible concentration of a contaminant in drinking water as listed by the National Primary Drinking Water Regulations (NPDWR).

(E) **“Action level (AL)”** is the maximum permissible concentration of lead in drinking water as specified in the Code of Federal Regulations. ALs are levels used for contaminants that do not have established MCLs.

(F) **“TCE”** shall mean the organic chemical trichloroethylene (a common solvent) and its known degradation products, including but not limited to dichloroethylene and vinyl chloride.

(G) **“Impact area”** is defined as that land surface area that is underlain or surrounded by water-bearing units that contain groundwater above the MCL or AL for at least one contaminant of concern (lead, cadmium, TCE or TCE degradation products, or other contaminants of the NPDWR). Standard contouring methodology shall be used to delineate the MCL and AL isoconcentration line, which will define the geographic limit of an impact area.

(6) **Special Area 2.** All of Newton County and Jasper County shall be listed as Special Area 2 (Figure 7B included herein) due to the contamination of portions of the upper aquifer by one or more of the following: lead, cadmium, TCE, TCE degradation products or other contaminants of the NPDWR. The upper aquifer and lower aquifer are separated by a thickness of low-permeability bedrock (Figure 7A). This low-permeability bedrock limits migration of groundwater and any associated contamination from the upper aquifer to the lower aquifer. Wells that penetrate the low-

permeability bedrock without an adequate length of surface casing which has had the annulus sealed by approved methods through the low-permeability bedrock may place the lower aquifer at risk to future contamination. Due to chemical and metal contamination present in the upper aquifer in portions of this area, it is necessary to require more stringent well construction standards for new wells that are drilled into the lower aquifer, to cease construction of additional upper aquifer wells in impact areas, and to limit deepening of existing upper aquifer wells in impact areas. New wells constructed outside of the impact area shall be constructed to standards that are no less stringent than the minimum well construction requirements for Area 1. All persons engaged in drilling wells in Special Area 2 shall

(A) Before beginning construction of the well, determine if the well to be drilled is located within the impact area as shown on maps provided by the division or as determined by division staff. If data indicate change in impact area status, the impact area map may be modified by the division during January of the calendar year and that map will be maintained and available at Department of Natural Resources, P.O. Box 250, Rolla MO 65402-0250.

(B) Drill new wells within the impact area to a depth required to produce water from the lower aquifer. All new wells drilled in the impact area shall have steel or plastic casing properly installed and grouted to the depth determined by the Special Area 2 casing depth map.

1. The drill hole shall be a minimum of 8 5/8 inches in diameter to the surface casing point;

2. New steel casing shall be installed as specified in 10 CSR 23-3.030 (steel);

3. The well must be sealed by positive displacement grouting with high-solids bentonite slurry. The annulus between the casing and the borehole wall shall be grouted from the base of the borehole. The volume of grout shall be no less than the calculated volume necessary to accomplish full-length grouting of the annulus. Alternatively, full-length pressure grouting (10 CSR 23-3.030 (3) (A) 4.) with high-solids bentonite slurry or neat cement meets the requirements of this rule.

In addition, casing must be sealed as follows:

A. When steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure as specified in subsection (6) (B) 3. C. of this rule before drilling resumes;

B. If plastic casing is used, a drill hole shall be constructed a minimum of 10 inches in diameter to the casing point. Plastic casing shall be installed as specified in 10 CSR 23-3.070 (plastic) and, a packer, coupling, or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. PVC and ABS plastic casing shall not be used when known gasoline or solvent contamination exists within the impact area. The annular space shall be sealed as specified in subsection (6) (B) 3. of this rule. No packer, coupling, or inverted bell is required on wells where the grout is allowed to cure as specified in subsection (6) (B) 3. C. of this rule before drilling resumes; and

C. The following times must be allowed for curing grout when no packer is used:

(I) High-solids bentonite slurry - varies based on additives and manufacturer's specifications. At least one hour of curing after initial slurry placement is suggested. This amount of curing time should elapse during casing placement.

(C) Uncontaminated upper aquifer wells in impact areas of Special Area 2 existing before the date of this rule may be deepened to the top of the low-permeability bedrock.

(D) Water from all new wells and deepened old wells throughout Special Area 2 shall be sampled and analyzed for lead and cadmium, plus TCE and its degradation products within TCE impact areas. Where indicated by objective factors, the division may require sampling and analysis for other contaminants listed in the NPDWR. Qualified and properly trained persons must complete sample collection. The laboratory that analyzes the sample must be approved by the EPA for such analysis. A copy of the chain of custody form shall be submitted to the division with the well certification report form to document sampling has occurred. An appropriate chain of custody form will be available from the division.

1. In order to ensure proper well development, the well pump must run continuously for 5 hours or until the water clears, whichever occurs first, but in no case shall the well be pumped less than 2 continuous hours.

2. After proper well development, water samples shall be collected from the tap nearest the well.

3. All new and deepened old wells in Special Area 2 shall be constructed with a sampling port or tap within 10 feet of the wellhead. Water must be purged from the sampling port prior to collection of a sample.

4. Water from all new wells in Special Area 2 with less than three times the applicable maximum contaminant level (MCL) or action level (AL) may be retested over a one-month period following pump installation and development to assess water quality changes that may have resulted from drilling and/or well construction. The well can not be used for human consumption until contaminant levels are below MCLs or ALs. Qualified and properly trained persons must complete sample collection. The laboratory that analyzes the sample must be approved

by the EPA for such analysis. A copy of the chain of custody form shall be submitted to the division with the well certification report form to document sampling has occurred. An appropriate chain of custody form will be available from the division. The division may require any new well, whose contaminant levels do not fall below MCLs or ALs after the retest period, to be plugged.

5. Properly constructed new lower aquifer wells that are determined to be contaminated may be allowed to use water treatment systems on a variance basis, if other domestic water sources are not available at the time of well construction.

Otherwise, the well must be plugged by using full-length, high-solids bentonite grout emplaced by tremie pipe which extends to within 25 feet of the bottom of the borehole. Grout, extending from the bottom of the borehole to within 2 feet of land surface and finished per 10 CSR23-3.110(2)(A) 3.G., is preferred; in any case, the minimum volume of grout shall be no less than the volume calculated as necessary to accomplish full length plugging of the well.

6. Existing wells that extend uncased and/or unsealed through the low-permeability bedrock and that are found to be contaminated with lead, or cadmium, or TCE, TCE degradation products, or other contaminants of the NPDWR may be required to be plugged full-length with high-solids bentonite grout, emplaced by tremie pipe, which extends to within 25 feet of the bottom of the borehole. Grout, extending from the bottom of the borehole to within 2 feet of land surface and finished per 10 CSR23-3.110(2)(A) 3.G., is preferred; in any case, the minimum volume of grout shall be no less than the volume calculated as necessary to accomplish full length plugging of the well.

(7) **Special Area 3.** Portions of Franklin County within and south of the city of New Haven shall be listed as Special Area 3 (Figures 7B and 7C included

herein) due to the contamination of portions of the aquifer by one or more of the following chemicals of concern: tetrachloroethylene (PCE), trichloroethylene (TCE), perchloroethylene (PCE) degradation products, TCE degradation products or other contaminants of the National Public Drinking Water Regulations (NPDWR). In this area it is necessary to utilize more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells.

(A) The division shall be consulted before constructing a new well in Special Area 3. The division will provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. The division must provide written approval for all new wells prior to construction.

(B) Before deepening a well in Special Area 3, groundwater sampling and analysis for the chemicals of concern must be conducted by qualified and properly trained individuals and the data submitted within 60 days of the sampling event by the well installation contractor to the division. The division must provide written approval for the deepening of all new wells in Special Area 3. Wells that have been sampled and analyzed and are contaminated with chemicals of concern exceeding Maximum Contaminant Levels (MCLs) and/or Action Levels (ALs) shall not be deepened.

(C) In addition to specific instructions that are provided by the division pursuant to 10 CSR 23-3.100(7)(A) and (B), the following must be performed at all new wells installed in Special Area 3:

1. All drilling-derived fluids and solid materials shall be containerized and sampled before disposal in an appropriate location based on analytical results.
2. All new and deepened old wells in Special Area 3 shall be constructed with a sampling port or tap within 10 feet of the wellhead. Water must be purged from the sampling port prior to collection of a sample.
3. After proper well development, water from all new wells located in Special Area 3 shall be sampled and analyzed for the chemicals of concern, as determined by the division. Qualified and properly trained persons must complete sample collection. In order to document sampling has occurred, a copy of the chain of custody form shall be submitted by the pump installation contractor to the division within 60 days of pump installation.
4. The data report from all analyses shall be made available by the pump installation

contractor to the division and the well owner within 60 days of the sampling event.

(D) At any well being drilled, per division guidance, in which PCE and/or TCE is encountered in a pure-product phase (also known as Dense Non-Aqueous Phase Liquid or DNAPL), drilling shall cease and the division shall be notified immediately. The division will determine further action.

(E) Properly constructed new or deepened wells that, upon sampling and analysis, are contaminated at levels exceeding MCLs or ALs shall:

1. Be plugged full-length using high-solids bentonite slurry, six percent, bentonite cement or neat cement grout placed under pressure via tremie pipe which extends to within 25 feet of the bottom of the borehole. Grout shall extend from the bottom of the borehole to within 2 feet of land surface. Prior to plugging all pumps and debris must be removed from the wells. Any liner must be removed or perforated if possible. Casing must be cut at least 3 feet below ground surface. A registration report and fee (if required) must be submitted within 60 days of abandonment.; or
2. With approval from the division, the well owner shall be allowed to install a water treatment system that is designed to properly treat the chemical(s) of concern. The well shall not be used for human consumption until sampling and analysis demonstrates that the water treatment system reduces contaminant levels below MCLs and/or ALs for all chemicals of concern. The division shall be provided a copy of the post-treatment analytical data by the pump contractor within 60 days of the sampling event.

(8) **Special Area 4.** Portions of St. Charles County west of the city of Weldon Spring shall be listed as Special Area 4 (Figures 7D included herein) due to the contamination of portions of the aquifer by one (1) or more of the following chemicals of concern: trinitrotoluene (TNT) and dinitrotoluene (DNT) at the U.S. Army Corps of Engineers (COE) site, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, dinitrobenzene (1,3-DNB), nitrobenzene (NB), nitrate, uranium, and trichloroethylene (TCE) at the

Department of Energy (DOE) Main Site, uranium and 2,4-DNT, at the DOE Quarry, or other contaminants of the National Public Drinking Water Regulations (NPDWR). In this area it is necessary to utilize more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells.

(A) The division shall be consulted before constructing a new well in Special Area 4. The division will provide specific guidance on well drilling protocol, construction specifications and groundwater sampling on a case-by-case basis. The division must provide written approval for all new wells prior to construction.

(B) Before deepening a well in Special Area 4, groundwater sampling and analysis for the chemicals of concern must be conducted by qualified and properly trained individuals and the data submitted within sixty (60) days of the sampling event by the well installation contractor to the division. The division must provide written approval for the deepening of all new wells in Special Area 4. Wells that have been sampled and analyzed and are contaminated with chemicals of concern exceeding Maximum Contaminant Levels (MCLs), Action Levels (ALs), and/or remediation goals included in the DOE/COE Record of Decision (ROD) for the Weldon Spring sites shall not be deepened.

(C) In addition to specific instructions that are provided by the division pursuant to 10 CSR 23-3.100(8)(A) and (B), the following must be performed at all new wells installed in Special Area 4:

1. All new and deepened old water wells in Special Area 4 shall be constructed with a sampling port or tap within ten feet (10') of the wellhead. Water must be purged from the sampling port prior to collection of a sample.
2. After proper well development, water from all new wells located in Special Area 4 shall be sampled and analyzed for the chemicals of concern, as determined by the division. Qualified and properly trained persons must complete sample collection. Sampling qualifications and training requirements will be determined in advance of sampling by the division and approval will be issued in written

format. In order to document sampling has occurred, a copy of the chain of custody form shall be submitted by the pump installation contractor to the division within sixty (60) days of pump installation.

3. The data report from all analyses shall be made available by the pump installation contractor to the division and the well owner within sixty (60) days of the sampling event.

(D) Properly constructed new or deepened wells that, upon sampling and analysis, are contaminated at levels exceeding MCLs, ALs, and/or remediation goals included in the DOE/COE ROD for the Weldon Spring sites shall:

1. Be plugged full-length using high-solids bentonite slurry, six percent (6%) bentonite cement or neat cement grout placed under pressure via tremie pipe which extends to within twenty-five feet (25') of the bottom of the borehole. Grout shall extend from the bottom of the borehole to within two feet (2') of land surface. Prior to plugging all pumps and debris must be removed from the wells. Any liner must be removed or perforated if possible. Casing must be cut at least 3 feet (3') below ground surface. A registration report and fee (if required) must be submitted within 60 days of abandonment.; or
2. With prior approval from the division, the well owner shall be allowed to install a water treatment system that is designed to properly treat the chemical(s) of concern. The well shall not be used for human consumption until sampling and analysis demonstrates that the water treatment system reduces contaminant levels below MCLs, ALs, and/or remediation goals included in the DOE/COE ROD for the Weldon Spring sites for all chemicals of concern. The division shall be provided a copy of the post-treatment analytical data by the pump contractor within sixty (60) days of the sampling event.

(E) Notwithstanding these provisions, the Federal Government does not waive its rights and authority under Federal law, regulations, or executive order within the boundaries and applicable jurisdiction of Federal property.

*AUTHORITY: sections 256.606 and 256.626, RSMo (Cum. Supp 1991). * Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective date Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed April 23, 2001, effective Dec. 30, 2001. Emergency rule filed March 21, 2005 effective April 1, 2005, expired Sept. 27, 2005. Amended: Filed Sept. 27, 2005, effective April 30, 2006. Amended: Filed May 5, 2007, Effective July 30, 2007. Original Authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-3.110 Plugging of Wells

PURPOSE: This rule establishes criteria for the proper plugging procedures to be followed when abandoning a well. Plugging procedures for monitoring wells are contained in 10 CSR 23-4.080, for heat pump wells in 10 CSR 23-5.080 and for test holes in 10 CSR 23-6.050.

(1) Any well which is to be abandoned must be plugged in accordance with these rules. If a well has been determined to present a threat to groundwater, the division may order that the well be permanently plugged. If a well is in such a state of disrepair (such as the pump has been removed or the water line disconnected) that continued use for purposes of obtaining groundwater is impractical and which has not been in use for a period of 2 years or more, the division may order that the well be permanently plugged.

(2) Permanent Abandonment of Wells.

(A) Plugging the Well.

1. A well that is to be permanently abandoned shall be disconnected from the water distribution system and the hole filled to prevent contaminating materials from entering the subsurface water-bearing formations and groundwater from one aquifer mixing with that of another aquifer. Bentonite or cement grout shall be used for grouting material. If the well is so large that the use of these materials is not practical, the division will determine a proper plugging schedule. All materials, debris and obstructions that may interfere with plugging operations shall be removed from the well. Liner pipe shall be removed or perforated when necessary to assure placement of an effective plug.

2. The division must be consulted for instruction in case of abandonment of a contaminated well or where there is a question of proper procedure. Sampling of the fluids in the well may be required. A permitted drilling or pump installation contractor must be utilized to plug well.

(B) An abandoned well shall be plugged by one of the following methods in this section in accordance with the materials penetrated, in such a manner as to prevent it from acting as a channel for pollution. A report of the method of plugging shall be filed with the division on a registration report form that is provided by the division.

(C) Plugging requirements contained in 10 CSR 23-3.010 - 3.100 do not pertain to bedrock irrigation wells and public water supply wells which include community, noncommunity and nontransient noncommunity type wells. Plugging requirements for these types of wells will be determined on a case- by-case basis by the division and must be performed by a permitted contractor and may be more stringent than those for domestic and multifamily wells.

1. Hand dug wells and bored wells no deeper than 80 feet. To plug this type of well, the following steps must be followed (see Figure 9):

- A. Remove all pumps, pipe, debris and surface coverings or concrete cap;
- B. Push in top 3 feet of well lining. Lining may be composed of rock, brick or tile. If lining is composed of any other material consult the division for further instructions;
- C. Fill well to within 3 feet from the surface with clean fill such as gravel, sand, varied sized agricultural lime or other approved material;
- D. Disinfect fill material. If there is water in the well, chlorine must be added to bring its concentration to at least 100 parts per million (see Table 1 in 10 CSR 23-3.050). As the fill material is poured into the well, it is disinfected as it comes in contact with the chlorinated water. If there is no water in the well to be plugged, disinfect the fill material before it is placed into the well;
- E. Fill the remaining hole with clay or clay-rich soil. Soil should be mounded slightly at the top to help offset settling; and

F. Submit registration report form and fee to the division.

2. Wells completed in unconsolidated deposits. This type of well includes alluvial wells, glacial drift wells and nonbedrock wells. To plug this type of well, the following steps must be followed:

- A. Remove all pumps, pipe and debris from well;
- B. Dig around casing and remove top 3 feet of casing. The remaining hole must be at least 2 feet in diameter larger than the existing casing (see Figure 10);
- C. Fill well from total depth to 50 feet from surface with clean fill such as gravel, sand, varied sized agricultural lime or other approved material;
- D. Disinfect fill material. If there is water in the well, you must add chlorine to the water bringing it to a concentration of at least 100 ppm (see Table 1 in 10 CSR 23-3.050). As the fill material is poured into the well, it is disinfected as it comes in contact with the chlorinated water. If there is no water in the well to be plugged, disinfect the fill material before it is placed into the well;
- E. Place a grout plug that fills the upper 50 feet of casing and extends into the larger excavated area, at least 1 foot. In agricultural or yard settings the remaining hole above the grout plug must be filled with soil. In other settings, the remaining hole above the grout plug may be filled with clean fill if the well site is to be paved; and
- F. Submit registration report form and fee to the division.

3. Wells completed in bedrock. This type of well includes any domestic well that produces water from bedrock aquifers (see Figure 11). To plug this type of well, the following steps must be followed:

A. Remove all pumps, pipe and debris from well. Any liner must be removed or perforated if possible;
B. Dig around casing and remove top 3 feet of casing. The remaining hole must be at least 2 feet in diameter larger than the existing casing;

C. Fill well from total depth to 50 feet below bottom of casing with clean fill such as gravel, sand, varied sized agricultural lime or other approved fill material;

D. Disinfect fill material. If there is water in the well, you must add chlorine to the water bringing it to a concentration of at least 100 ppm (see Table 1 in 10 CSR 23-3.050). As the fill material is poured into the well, it is disinfected as it comes in contact with the chlorinated water. If there is no water in the well to be plugged, disinfect any fill material used before it is placed into the well;

E. Place cement or bentonite from a point 50 feet below the bottom of the casing to 2 feet from the surface making sure the grout extends into the excavated area at least 1 foot. If the water level is above a point 50 feet below the bottom of the casing, then bentonite chips must be used or the cement or bentonite slurry must be emplaced through a tremie pipe lowered through the water level to the top of the fill. Under no circumstances may cement or bentonite slurry be poured through large columns of water without the use of a tremie pipe (see paragraph (2)(C)6 for alternative plugging technique);

F. May plug the well, if the well has 150 feet or more of casing, by filling the well with clean aggregate to a point 50 feet below the bottom of the casing, placing a grout plug from this point extending up into the casing 30 feet. From this point to within 50 feet of the surface, clean aggregate fill may be used. From

50 feet to 2 feet must be filled with grout making sure the grout extends into the excavated area at least 1 foot;

G. Cut casing off at top of bedrock, if bedrock is encountered when digging around the casing, and fill remaining hole with cement slurry. In agricultural or yard settings, the plug must terminate at least 2 feet below the finished surface grade and the remaining hole filled with soil. In other settings, the remaining hole may be filled with clean fill if the well site is to be paved; and

H. Submit registration report form and fee to division.

4. For those wells which casing depth, water level and total depth are not known and cannot be determined, plugging instructions will be determined on a case-by-case basis and may be more stringent.

5. As clean fill is being placed into a well, periodic measurements should be taken to ensure that the fill does not reach a point closer than 50 feet below the bottom of the existing casing. If fill is placed above this point, plugging schedules will be determined by the division and may result in removal of fill material.

6. When plugging a well that contains water that is above a point of 50 feet below the bottom of the casing or liner, whichever is deeper, cement slurry may be poured into the well if a tremie pipe is placed in the well to near the bottom and acts as a conduit for the water to escape through as the cement slurry is poured into the well casing from the surface. The cement slurry must be poured in one continuous operation. Mixing small batches and pouring is not permitted.

7. The flow in a flowing well shall be confined, if possible, and the well plugged in accordance with well plugging requirements supplied by the division which will be determined on a case-by-case basis. Proper judgment shall be exercised in the feasibility of plugging flowing wells. In some cases the confining formation may have been so badly disturbed that plugging may only cause the flow to discharge in a less appropriate location.

In other situations, the flow may have eroded so much material that the landscape has taken on the appearance of a natural spring. The plugging in this case may be impractical, if not impossible.

(3) Owners Responsibility for Plugging Well. The owner shall be responsible for the permanent plugging of an abandoned well except when the permittee improperly locates, constructs or completes the well. The permittee shall then be responsible for the plugging of the well.

(4) Wells Abandoned by Landowners. Wells abandoned by landowners after Aug. 28, 1991, shall be plugged or cause to be plugged, in accordance with this rule. Landowners may plug their own wells located on property they own or lease, if the wells were intended for use only in single-family houses which are their permanent residences or were intended for use only for farming purposes on their farms, and where the waters that were produced were not intended for use by the public or in any residence other than their own. If a landowner pays someone to assist in the plugging of the well, that person must hold a current Missouri well installation contractor permit or Missouri pump installation contractor permit except as stated in 10 CSR 23-1.090(2) concerning hand dug wells. If the division makes a finding that certain unusual conditions exist at a well that is to be plugged, the division may require that the well be plugged by a permitted well installation contractor or a permitted pump installation contractor. Unusual conditions exist at a well that is to be plugged if the total depth, amount of casing and water level are not known; a liner is in the well; foreign objects are stuck in the well; the well is contaminated with pollutants other than bacteria; or other conditions determined by the division on a case-by-case basis.

(5) A permittee or landowner who permanently abandons any well that is removed from service shall report the abandonment to the division on a registration report form provided by the division. A permittee or landowner shall report to the division any unplugged abandoned wells existing on his/her property (landowner) or property on which a permittee is hired to perform well drilling repair or pump installation.

(6) All wells may be plugged by filling the well via tremie or pressure grouting with cement slurry, bentonite or bentonite slurry from total depth to 2 feet from the surface, if this method exceeds other minimum standards.

(7) If the division finds that certain conditions for high potential of groundwater contamination exist at a well, the division may require that a permitted well installation contractor or pump installation contractor be contracted to plug the well.

*Auth: sections 256.606, 256.614, 256.615 and 256.626, RSMo (Cum. Supp. 1991). * This rule was previously filed as 10 CSR 23-3.020(3)-(9). Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. *Original authority: 256.606, RSMo (1991); 256.614, RSMo (1985), amended 1991; 256.615, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

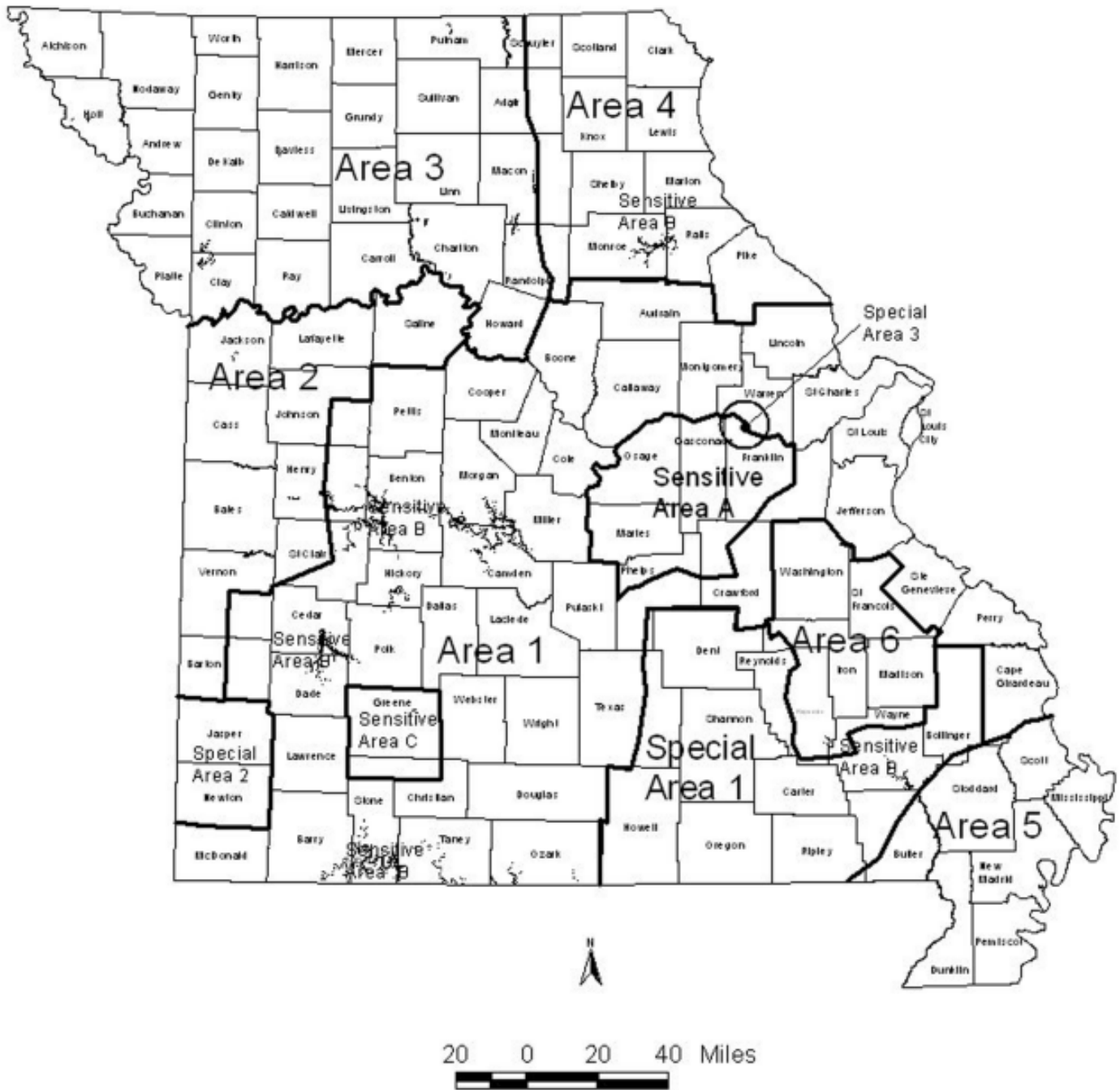


Figure 1. Map showing drilling areas for private well construction regulations. Areas are enlarged in maps on following pages.

Area 2

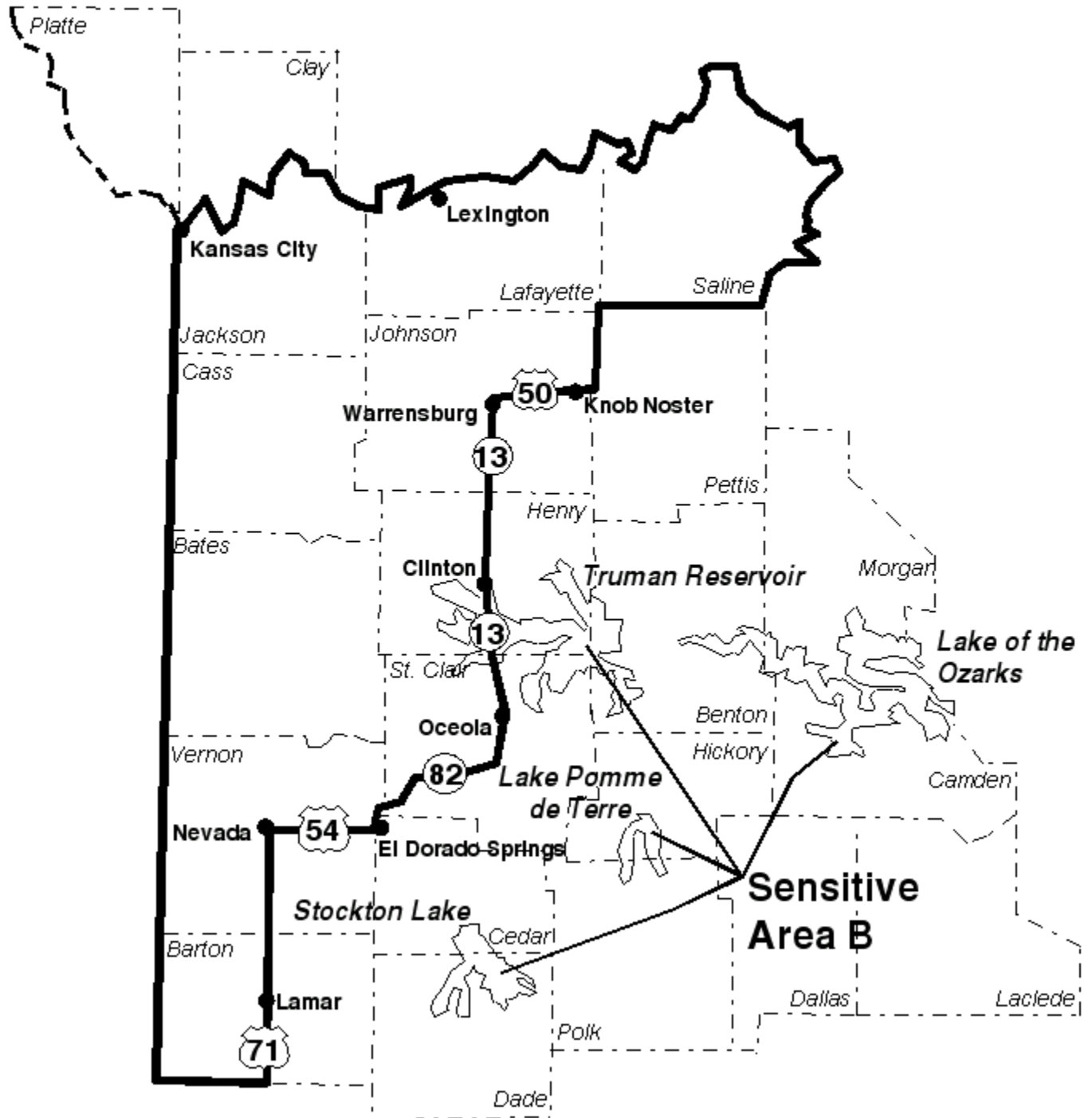


Figure 2. Enlargement of Area 2 and Sensitive Area B map.

Area 3

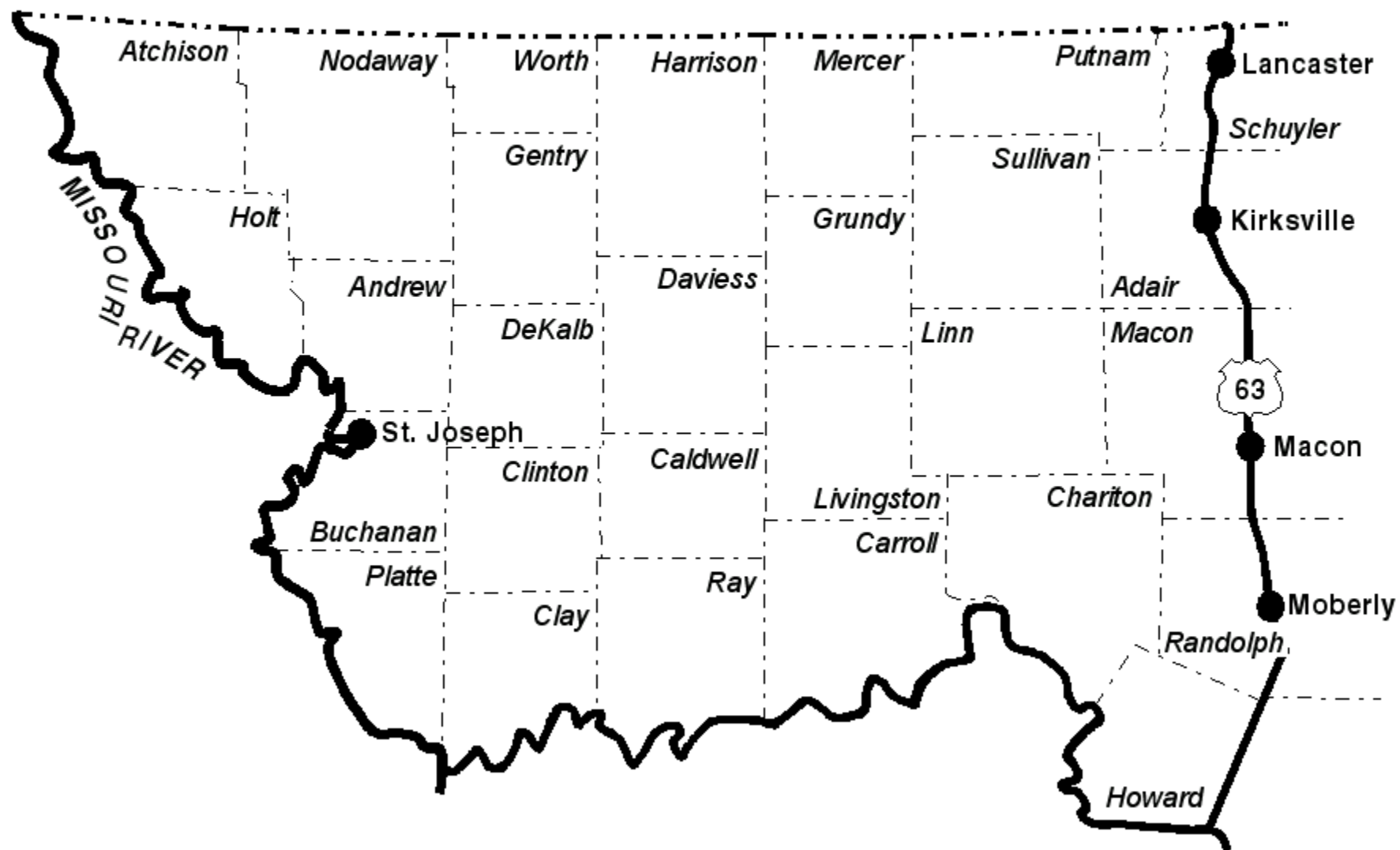


Figure 3. Enlargement of Area 3.

Area 4

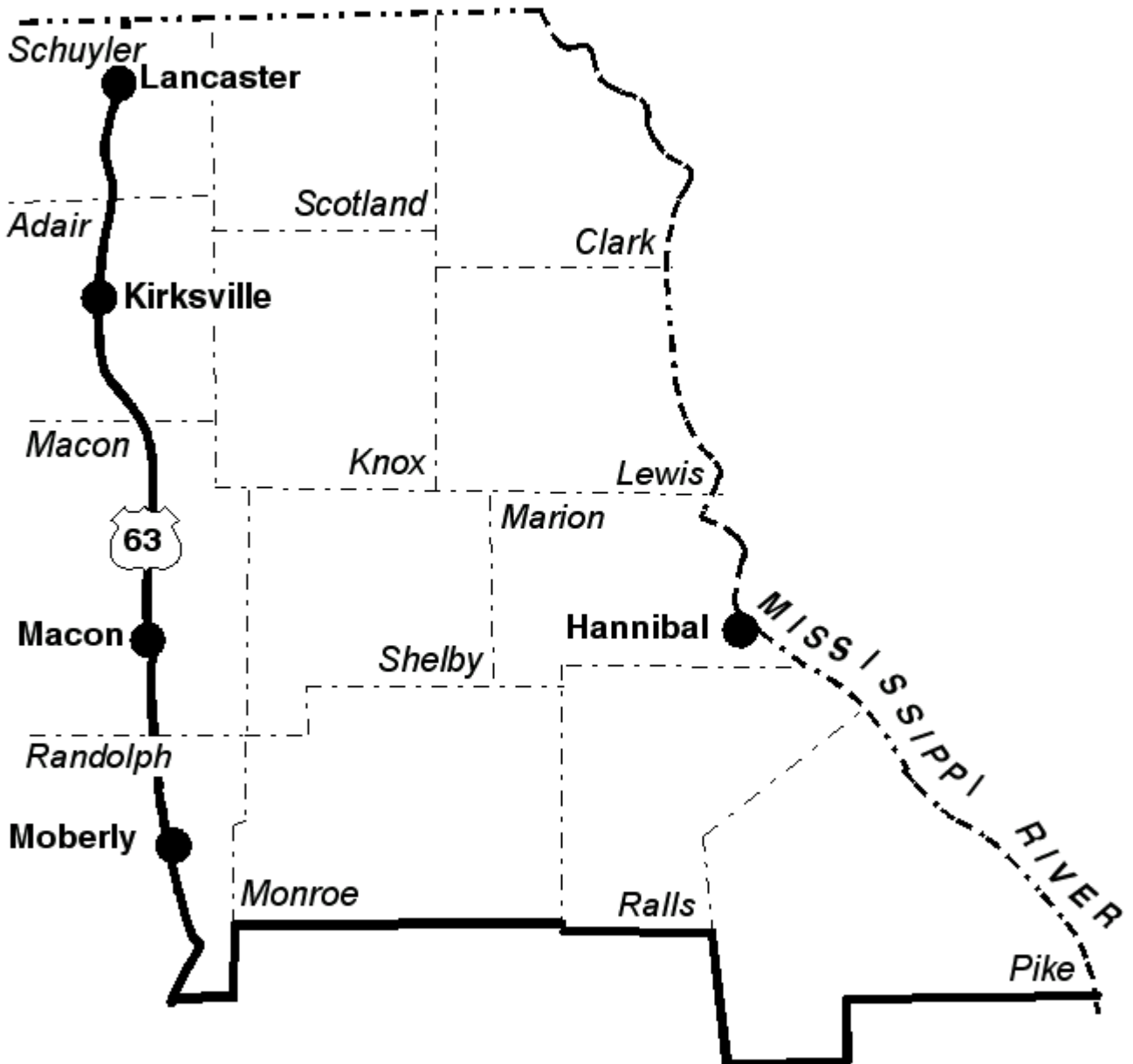


Figure 4. Enlargement of Area 4.

Area 5

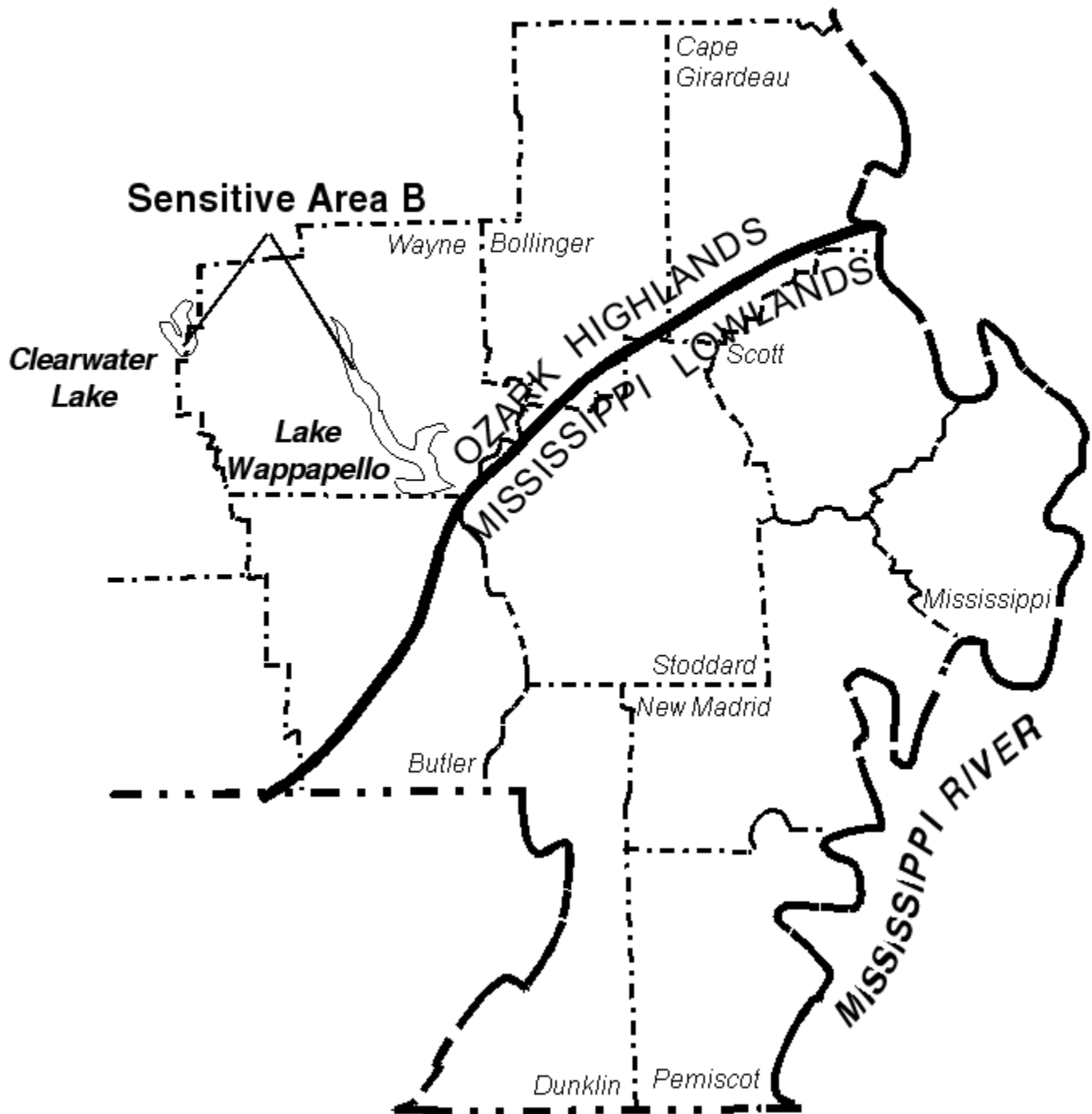


Figure 5. Enlargement of Area 5 and part of Sensitive Area B map.

Area 6

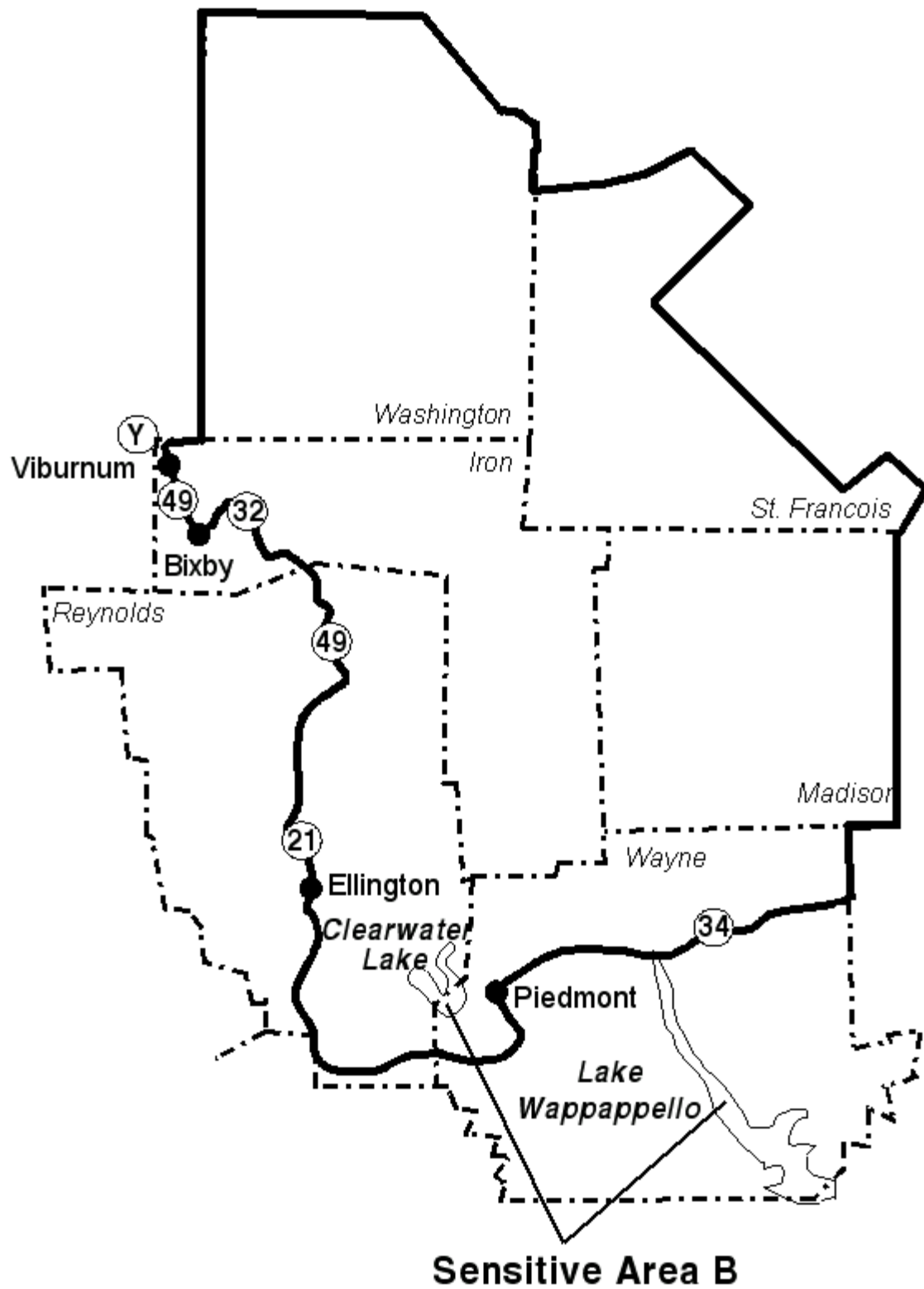


Figure 6. Enlargement of Area 6 and part of Sensitive Area B map.

Special Area 1

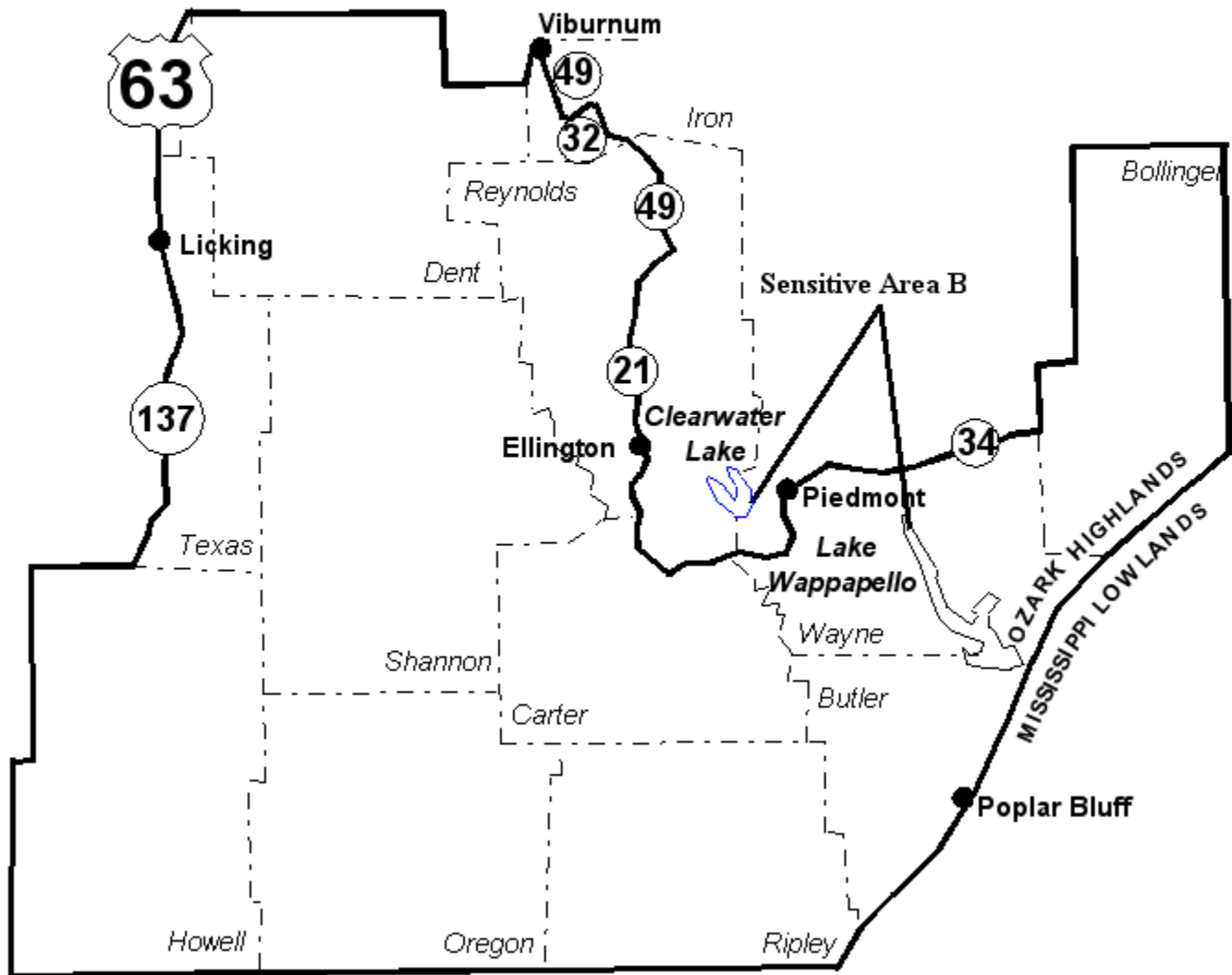


Figure 7. Enlargement of Special Area 1 and part of Sensitive Area B map.

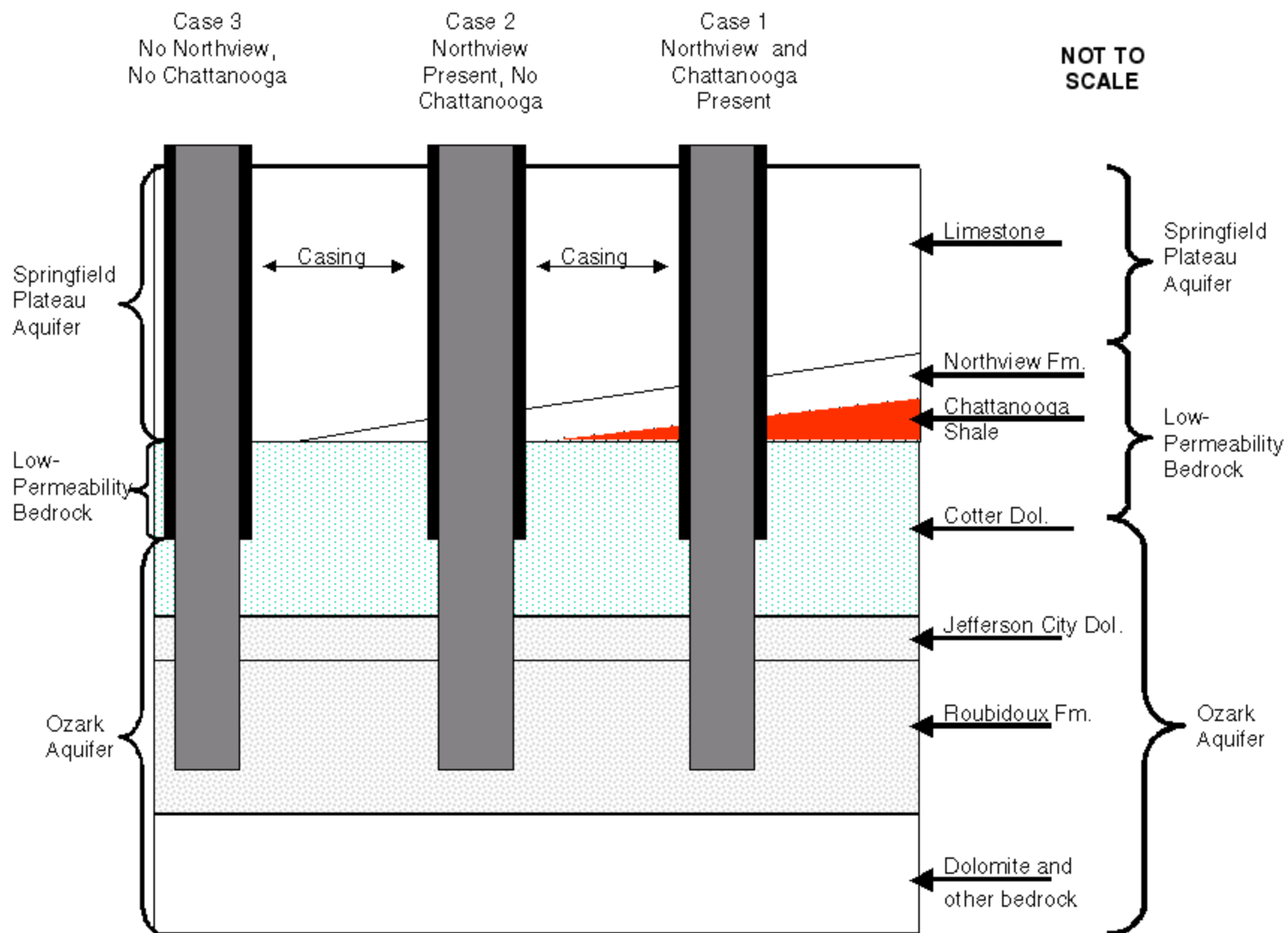


Figure 7A. Special Area 2 Geology and Well Casing.

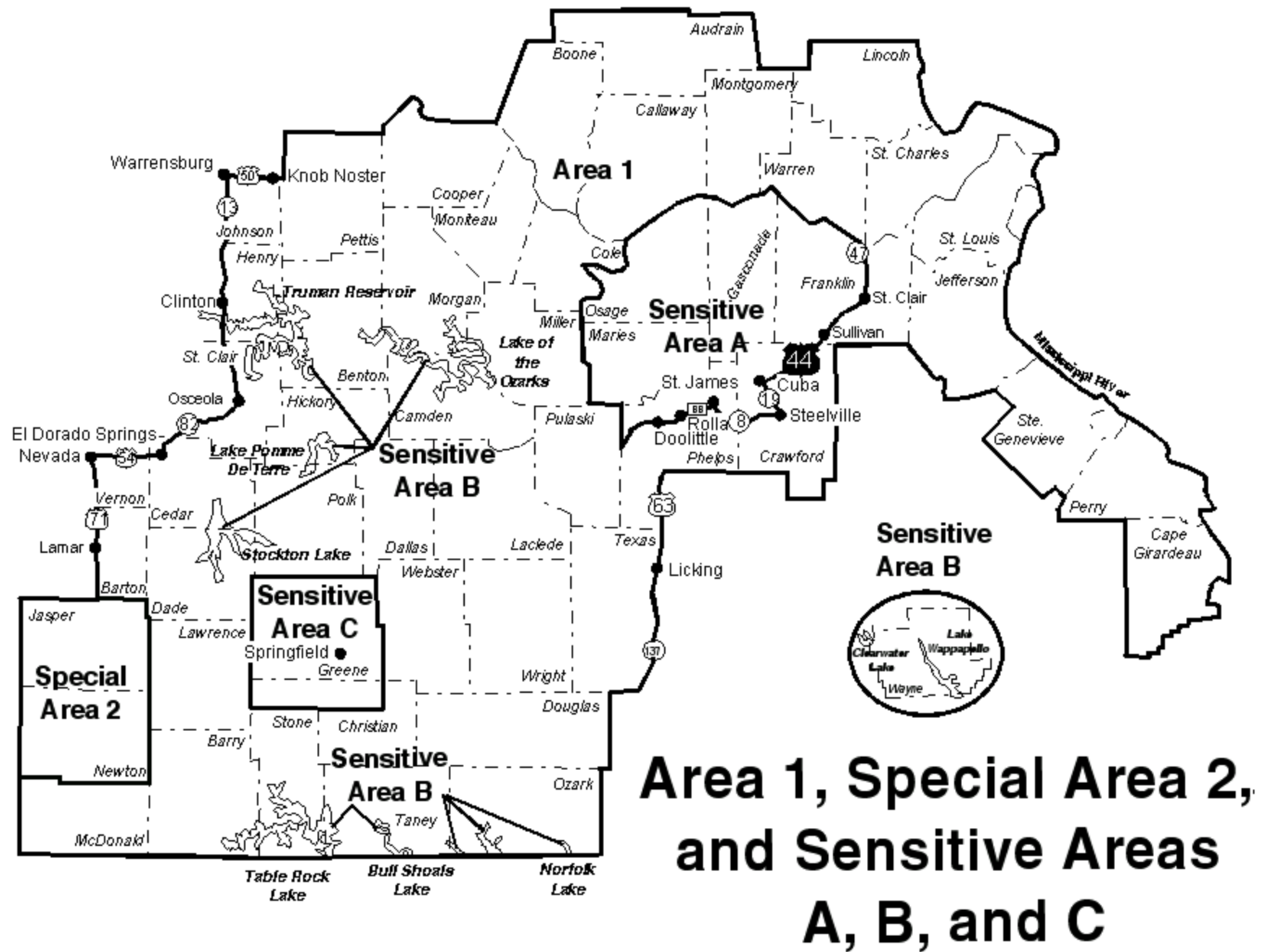


Figure 7B. Area 1, Special Area 2, Sensitive Areas A, B, and C map.

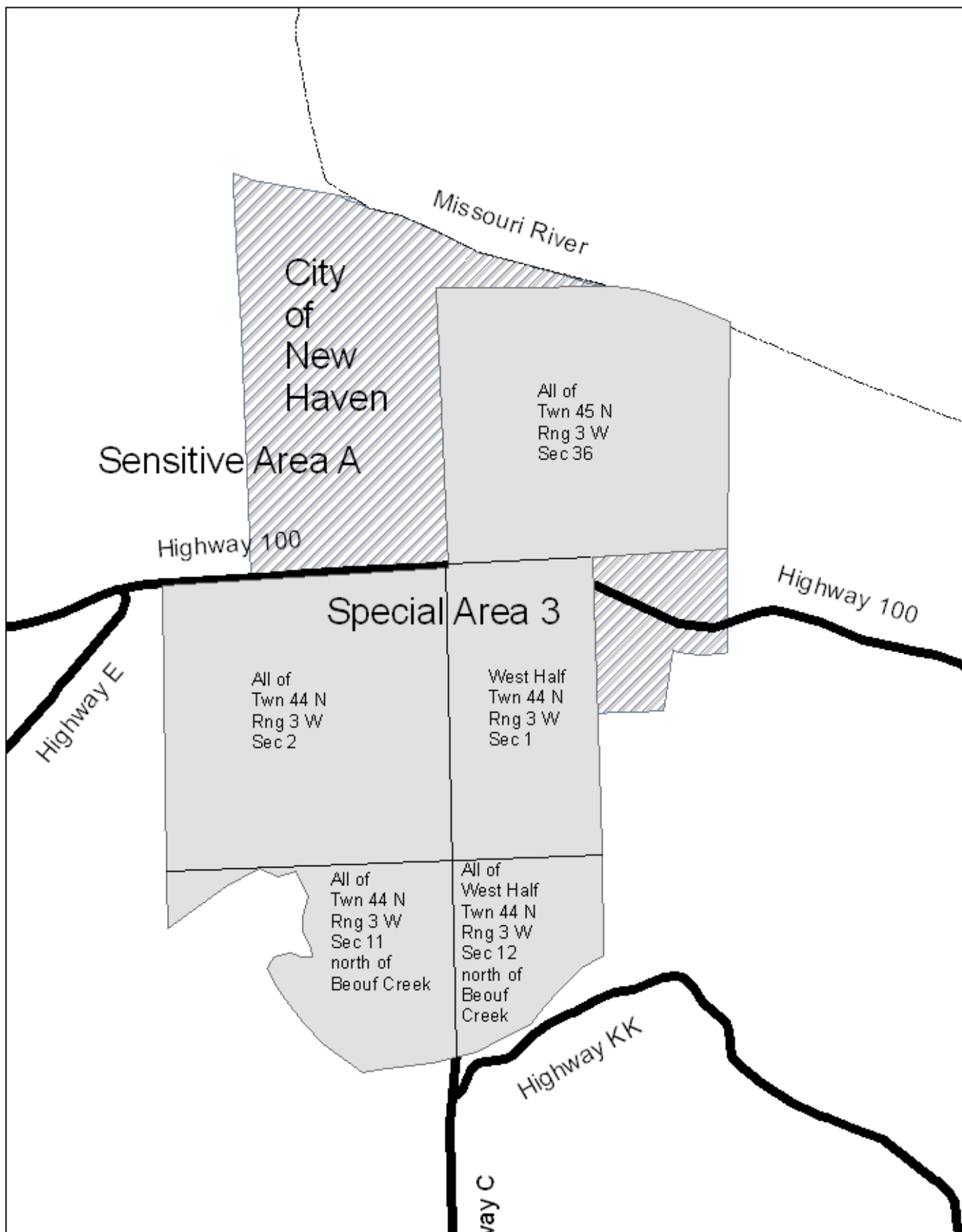


Figure 7C. Special Area 3 and Sensitive Area A

Special Area 4

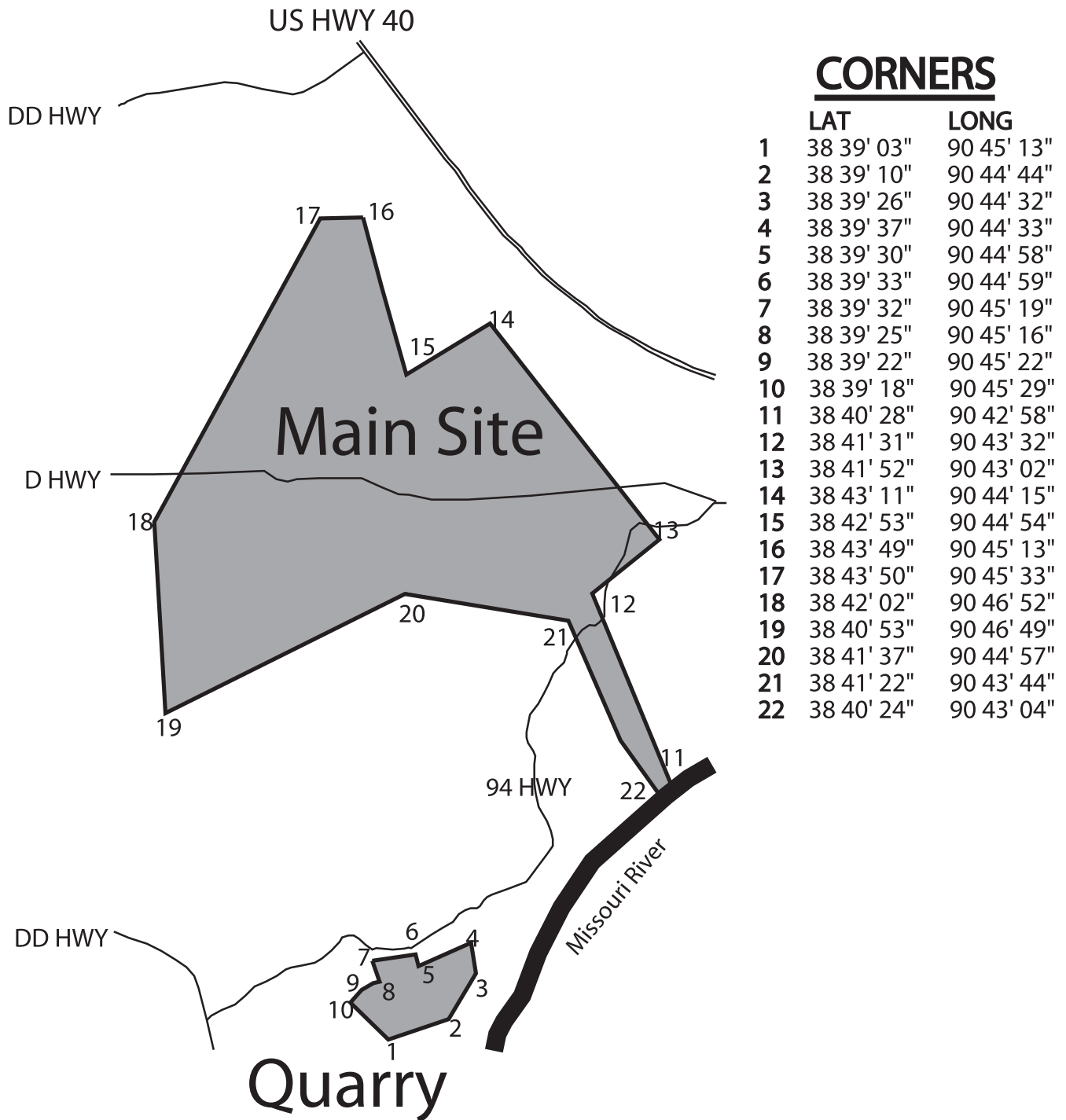


Figure 7D. Special Area 4, Weldon Spring Federal Area

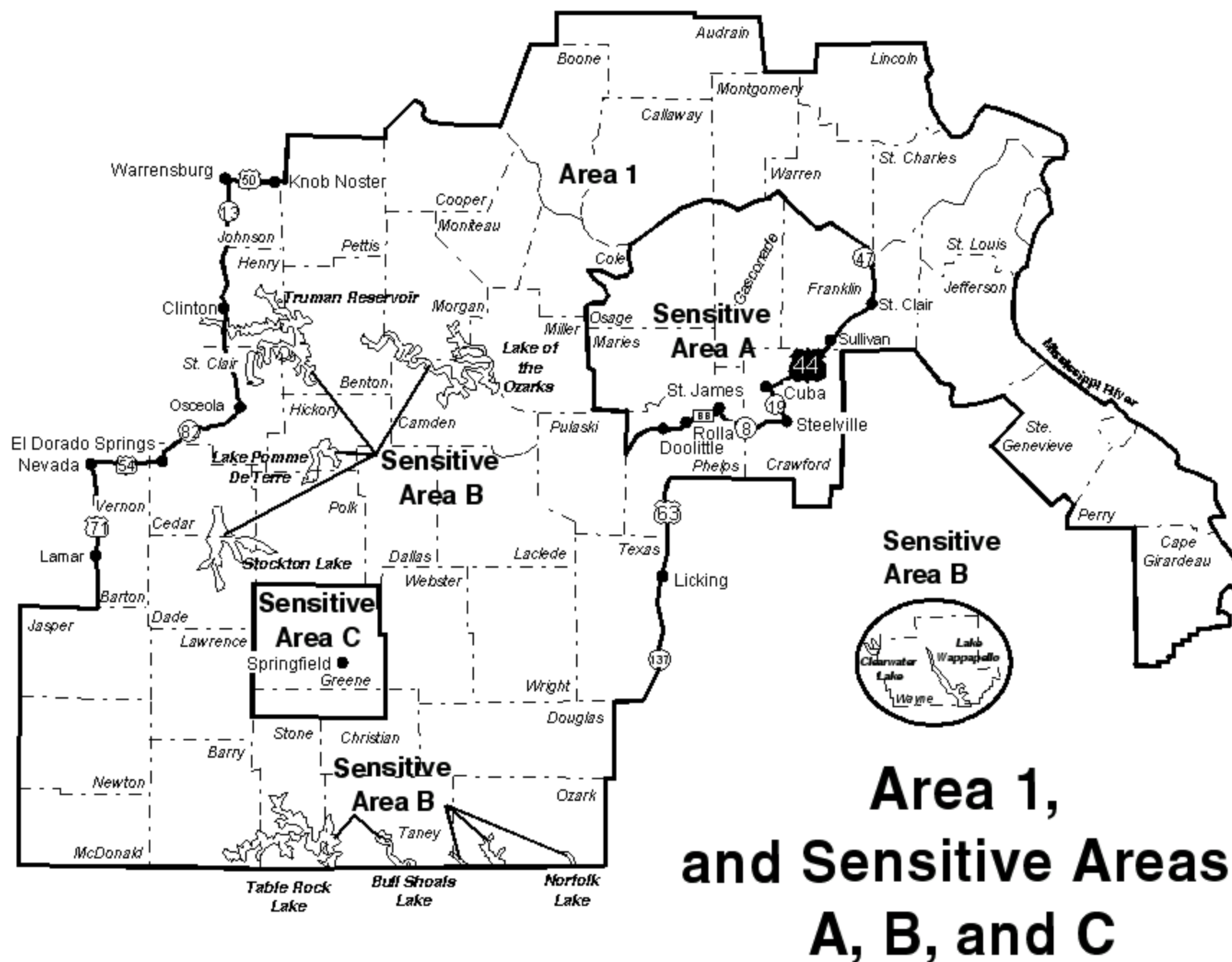


Figure 8. Area 1, Sensitive Areas A, B, and C map.

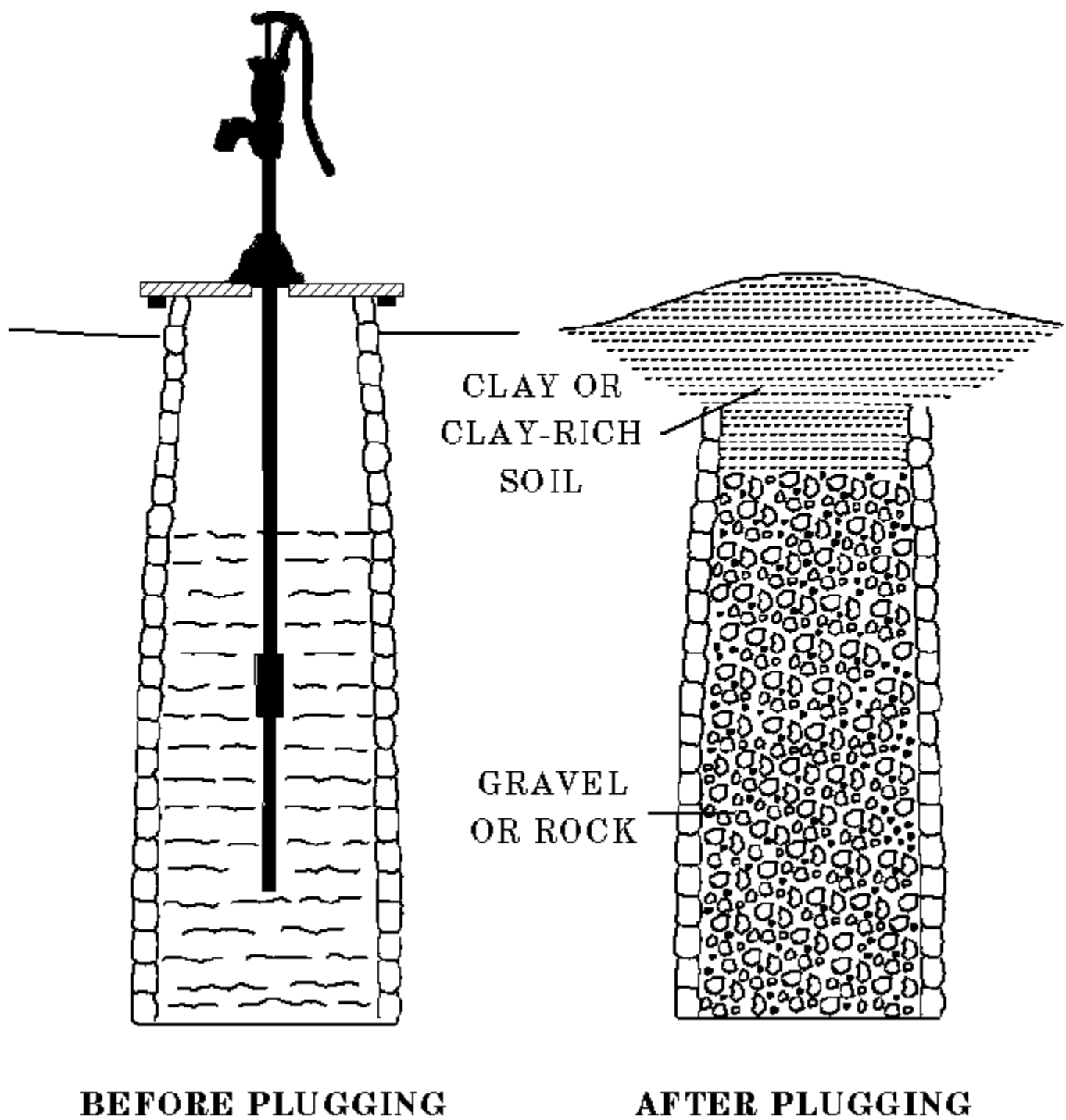


Figure 9. Plugging diagram for dug wells.

PLUGGING DOMESTIC WELLS IN UNCONSOLIDATED DEPOSITS

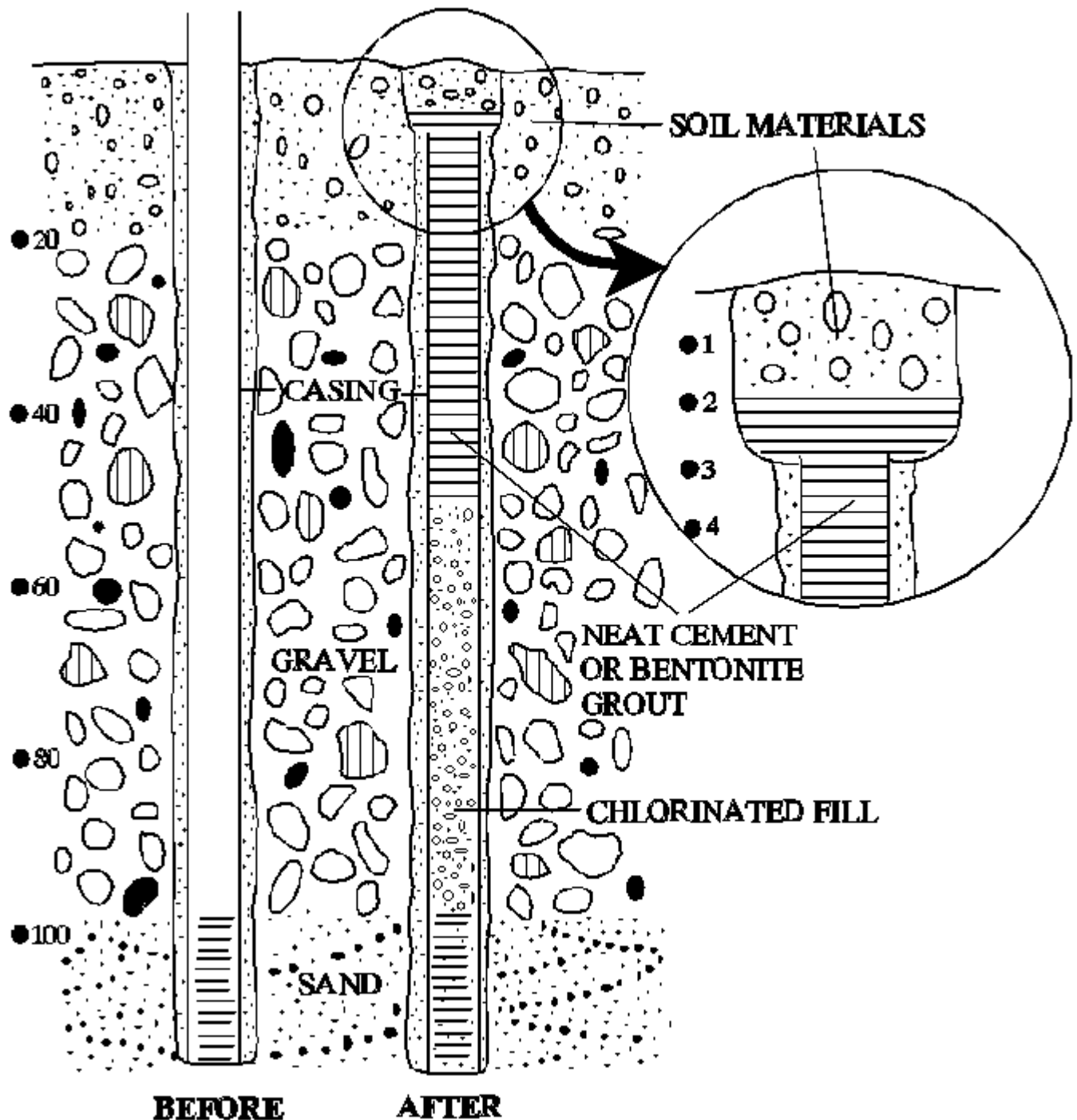


Figure 10. Plugging diagram for domestic wells in unconsolidated deposits.

PLUGGING DOMESTIC WELLS IN BEDROCK

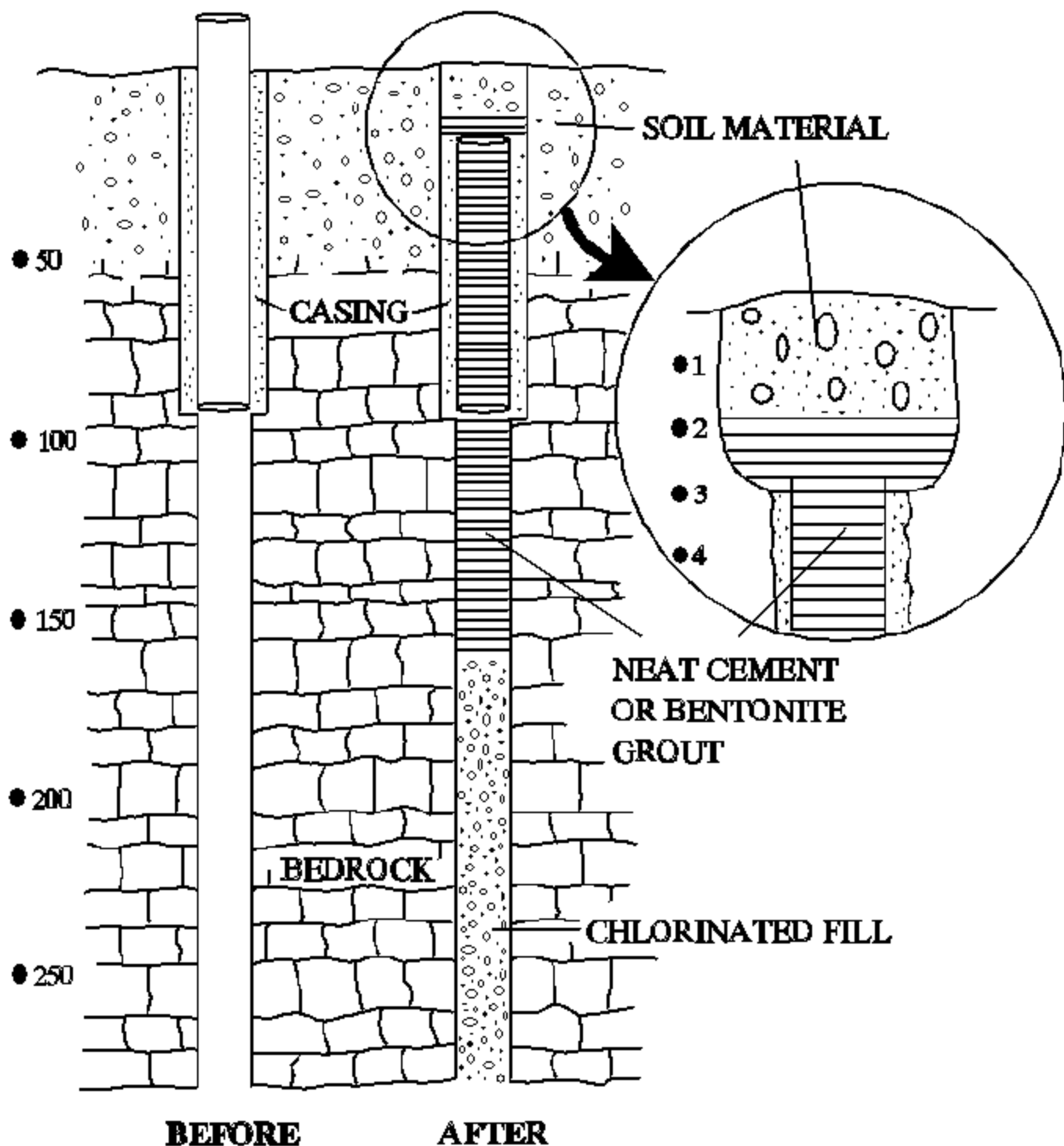


Figure 11. Plugging diagram for domestic wells in bedrock.

Chapter 4

Monitoring Wells Construction Codes

Title 10 - DEPARTMENT OF NATURAL RESOURCES
Division 23 - Geology and Land Survey

Chapter 4 - Monitoring Well Construction Code

PURPOSE: The rules contained in Chapter 4 cover wells drilled for the purpose of monitoring water quality or for hydrologic studies.

10 CSR 23-4.010 Definitions

PURPOSE: This rule specifically defines words used in chapter 4 concerning monitoring wells, otherwise the definitions contained in 10 CSR 23-1.010 apply.

(1) **Extraction well** means any well more than ten (10') in depth utilized in the remediation of a site. These include but are not limited to the following: wells serving pump and treat systems, wells to capture a contaminant plume or alter the direction of magnitude of groundwater movement, leachate recovery wells that are not a part of the original landfill construction and other associated wells. Passive and active methane wells in landfills are exempted from these rules, but are regulated under Solid Waste Law.

(2) **Monitoring well** means a well that is constructed to obtain site-specific water quality, contaminant movement or hydrologic data from proposed or existing waste disposal, waste processing, waste storage, hazardous materials release or other sites which may impact groundwater quality. This includes extraction wells used in the remediation of the site, piezometers for the collection of geologic and hydrologic data, observation wells and field screening technologies such as soil gas monitoring or push-in well screen temporary wells greater than 10 feet in depth but excludes wells constructed in the tank pit used as a part of an underground storage tank leak detection system and piezometers used to monitor the geotechnical performance of dams. Monitoring wells less than 10 feet in depth are exempt from reporting rules but must be plugged (see 10 CSR 23-4.080(5)).

(3) **Nominal diameter** means the term used to describe the standard sizes for casing. Depending on the wall thickness, the inside diameter of the casing may be less than or greater than the number indicated. For example, 2 inch nominal Schedule 40 polyvinyl chloride (PVC) casing has a standard outside diameter of 2.375 inches and an inside diameter of 2.067 inches; 2 inch nominal Schedule 80 PVC casing has the same outside diameter, but has an inside diameter of only 1.939 inches.

(4) **Open-hole completion** means a monitoring well cased through all overburden material and upper water producing zones, completed in bedrock, with no well screen or filter pack.

(5) **Piezometer** means a groundwater monitoring well, screened or opened to a saturated interval, installed for the specific purpose of determining either the elevation of the potentiometric surface or the physical, chemical, biological or radiological properties or both, of groundwater at some point within the saturated zone.

(6) **Potentiometric surface or piezometric surface** means an imaginary surface representing the total head of groundwater and is the level to which water will rise in a well.

(7) **Protective casing** means the casing set from a point below the frost line and extends at least 1 1/2 feet above the finished grade. The bottom of the casing must be at least 2 feet below ground surface. This casing is set to protect the monitoring well from damage.

(8) **Riser pipe** means the casing extending from the well screen to or above the ground level.

(9) **Water table observation well** means any monitoring well, in which the screen or open borehole intersects a water table, which is installed for the specific purpose of determining either the elevation of the water table or the physical, chemical, biological or radiological properties, or both, of groundwater at the water table.

(10) **Temporary monitoring well** means a well or hole used for field screening purposes such as soil gas monitoring, push-in type holes, auger holes, etc. that are greater than 10 feet in depth and are plugged within 30 days of completion. These wells may or may not have temporary pipes installed for various purposes.

(11) **Concrete** means a slurry mixture with a ratio of 94 pounds of cement, equals volumes of dry sand and gravel and five to six gallons of water from a known safe and uncontaminated source. The ratio of sand and gravel to cement may not exceed three parts to one (3:1).

*Auth: sections 256.603, 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.603, RSMo (1985), amended 1991; 256.606, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-4.020 Certification and Registration for Monitoring Wells

PURPOSE: This rule sets required standards for certification report form submittal.

(1) A certification report form, supplied by the division, shall be used to report new monitoring well construction. The certification report form shall be completed and submitted to the division by the permittee within 60 days after the completion of any well. The certification report form shall be accompanied by the certification fee (see 10 CSR 23-2 for applicable fees). The permittee shall furnish the well owner one copy, the division one copy and retain one copy in the permittee's files.

(2) The certification process involves the review of the certification report form to be sure that the well meets all construction requirements necessary for the specific area the well has been drilled. Upon successful completion of review of the certification report form, a certification number will be assigned and sent to the well owner. The issuance of the certification number indicates that the well has met the minimum standards set out in these rules. The minimum construction standards were written to protect Missouri's groundwater and to help ensure the construction of the wells does not constitute a threat to this resource.

(3) The registration process involves the documentation of certain types of activities according to the requirements and reported on forms supplied by the division.

(4) A registration report form, supplied by the division, shall be used to report the plugging of wells and the major repairs and alterations made to monitoring wells and must be submitted to the division by the permittee within 60 days after completion of such operations. Temporary monitoring wells are required to be plugged within 30 days after initial completion. Only a registration report form is required to document plugging of temporary monitoring wells. The registration report form shall be accompanied by the registration fee. The permittee shall furnish the well owner one copy, the division one copy and retain one copy in the permittees files. The registration report form shall contain all required information.

*Auth: sections 256.606, 256.614 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.614 and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-4.030 Location of Wells

PURPOSE: This rule sets criteria for the locations a monitoring well should be placed.

(1) A monitoring well shall be

- (A) Located so that the well and its surrounding area can be kept in a sanitary condition and provide ready access for maintenance and repairs;
- (B) Located, if possible, so proper drainage in the vicinity of the well shall be provided to prevent the accumulation and pooling of surface water within 10 feet of the well;
- (C) If at all possible, located in areas that do not flood. If no reasonable alternative site exists, special construction criteria will be determined on a case-by-case basis by the division; and
- (D) Located where possible farther than 15 feet from a cavity used for underground utility lines or an overhead electric distribution line or not 25 feet from an electric transmission line which is in excess of 50 kilovolt (kV), except for the underground electrical service line in the vicinity of an existing well or known proposed well. If it is necessary to locate wells under electric lines safety precautions should be taken. In areas of traffic, the wellhead must either be protected by pylons to prevent damage, or completed as a surface flush mount as described in 10 CSR 23-4.060(12)(B).

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-4.040 Drilling Methods for Monitoring Wells

PURPOSE: This rule ensures the method of drilling utilized allows a representative sample to be taken of the zone to be monitored and ensures the appropriate zone is being monitored.

- (1) There are many different drilling technologies available for permitted monitoring well drillers to utilize. The method of drilling chosen must not add contaminants to the well which would adversely affect the purpose of the well. Certain types of drilling methods can mask or hide the contaminants which are being monitored for or may not allow for collection of adequate geologic data to properly understand contaminant movement.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective January 29, 1995.*

**Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-4.050 General Protection of Groundwater Quality and Resources

PURPOSE: This rule prevents the use of monitoring wells for any purpose other than the purpose for which they were designed and allows certain modifications to the application of these rules.

(1) Monitoring wells shall not be converted to any other type of well unless approved in advance by the department.

(2) When strict application of these rules presents practical difficulties or unusual hardships, the division, in a specific instance, may modify the application of these rules consistent with the general purpose of these rules and the law. The division may then impose certain conditions as are necessary, in the opinion of the division, to protect the groundwater of the state and health, safety and general well-being of persons using, or potential users of the groundwater (see 10 CSR 23-1.040 Modification by the Division for procedures concerning variances).

(3) It is the obligation and responsibility of the monitoring well installation contractor to ensure that the well is constructed according to the rules and that the annular space is sealed. This obligation and responsibility with regard to the annular seal ends three (3) years after the date of certification, unless it can be shown that the well seal has been damaged by other persons. The well must be properly plugged or repaired when the well is no longer sealed.

(4) When drilling water is needed, it must be of potable quality.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-4.060 Construction Standards for Monitoring Wells

PURPOSE: This rule describes the minimum standards for a properly constructed monitoring well.

(1) Riser Pipe and Casing Material.

(A) Chemical Compatibility. Special consideration must be given to the selection of riser pipe or casing materials for monitoring wells installed in environments that are chemically reactive. The riser pipe or casing selected must resist chemical corrosion for the life of the proposed monitoring program. Chemical interaction between riser pipe or casing materials and pollutants, contaminants, groundwater, filter pack material and geologic materials could bias groundwater quality determinations. Well construction material must be selected that does not affect these determinations.

(B) Types of Riser Pipe and Casing Materials. The types of riser pipe and casing materials are divided into four categories-

1. Thermoplastic materials, including polyvinyl chloride (PVC) and acrylonitrile-butadiene-styrene (ABS);
2. Metallic materials, including carbon steel, low-carbon steel, galvanized steel and stainless steel (304 and 316);
3. Fluoropolymer materials, including polytetra-fluoroethylene (PTFE), tetrafluoroethylene (TFE), fluorinated ethylene propylene (FEP), perfluoroalkoxy (PFA) and polyvinylidene fluoride (PVDF); and
4. Other types of riser pipe and casing may be used if approval is obtained in advance from the division.

(C) All thermoplastic and fluoropolymer riser pipe and casings must meet the requirements set out in 10 CSR 23-3.070 (1)(D). This subsection sets standards for well casing markings. Thermoplastic and fluoropolymer riser pipe or casing used in monitoring well construction must meet the following minimum standards:

1. The nominal diameter of the riser pipe or casing must not be less than 2 inches except

that piezometers and field screening temporary wells may have smaller diameter casings. Monitoring wells utilizing two inch riser pipe that are greater than 100 feet in depth must use Schedule 80 pipe.

2. The wall thickness of the riser pipe or casing must not be less than the Schedule 40 for the nominal size riser pipe or casing selected. Thicker walls are recommended in deeper wells or in the presence of unstable materials. Wall thickness is also measured in standard dimension ratio (SDR) for thermoplastic riser pipe and casing;

3. Thermoplastic riser pipe and casing must be joined by a mechanical type joint. The joint must be watertight. If O-rings or fluoropolymer tape is used, they must be of inert materials which will not adversely affect the function of the monitoring well; and

4. Riser pipe and casing must be new and free from contaminants that would affect the quality of the groundwater or would adversely affect the monitoring.

(D) All metallic riser pipe and casings must meet the following minimum standards:

1. The nominal diameter of the riser pipe or casing must not be less than 2 inches, except that piezometers and field screening temporary wells may have smaller diameter casings;

2. The wall thickness for carbon, low-carbon and galvanized steel must not be less than Schedule 40. The wall thickness of stainless 304 and 316 must not be less than Schedule 5. The joint wall thickness must not be less than Schedule 40. Due to the thin wall of Schedule 5 stainless casing, threads are not machined into the casing itself. A threaded section of Schedule 40 stainless is welded onto the thin walled casing so that watertight connections can be made without losing strength;

3. Metallic riser pipe or casings must be joined by a watertight mechanical joint or welded. Welded joints can produce a stronger joint than mechanical joints but if explosive gases are present, they may be ignited by the welding process. The well must be checked for the presence of explosive gases before welding begins.

If explosive gases are present, precautions must be taken before construction continues; and

4. Riser pipe and casing must be new and free from contaminants which would affect the quality of the groundwater or would adversely affect the monitoring.

(2) Monitoring Well Borehole Preparation. Boreholes constructed for the installation of monitoring wells, including piezometers must be clean, free of obstructions, and must be at least 4 inches in diameter larger than the outside diameter of the riser pipe, screen and/or surface casing that is used. For wells with multiple strings of different sized casings, the annulus between the successive casing sizes must be at least 2 inches. Field testing methods such as soil gas holes and push-in well screen sampling holes are exempt from these borehole standards. When constructing a monitoring well that utilizes hollow-stem augers to bedrock, then rock drilling to total depth, the following exceptions may apply:

(A) When using an industry standard size 6 1/4 inches internal diameter auger to drill the unconsolidated material portion of the well, the bedrock portion of the well must be drilled with a bit which creates a hole that is at least 6 inches in diameter, if the well is constructed using a nominal 2 inch diameter riser pipe. This will leave an annulus of 1 5/6 inches within the bedrock portion of the well, which is the minimum allowable annulus for this type of monitoring well; and

(B) When using an industry standard size 8 1/4 inch internal diameter auger to drill the unconsolidated material portion of the well, the bedrock portion of the well must be drilled with a bit which creates a hole that is at least 8 inches in diameter, if the well is constructed using a nominal 4 inch diameter riser pipe. This will leave an annulus of 1 3/4 inches within the bedrock portion of the well, which is the minimum allowable annulus for this type of monitoring well.

(3) Piezometer Well Construction. A piezometer must be constructed according to this rule.

(4) Open-Hole Completions. Open-hole completed monitoring wells are allowed only upon written approval in advance from the division. In all cases, the open-hole portion of the well must be in competent, consolidated bedrock and casing must extend from the surface to at least 5 feet into bedrock. The casing must be grouted full-length.

(5) The joining of two dissimilar metals is not permitted due to the potential for galvanic corrosion.

(6) Decontamination of Well Construction Materials and Equipment.

(A) Hazardous Waste Sites. All materials used in the construction of the monitoring well must be decontaminated on-site by use of steam, high pressure water or be certified by the manufacturer as clean and be wrapped to ensure cleanliness. This includes, but is not limited to, the drilling rig, drilling equipment, drilling fluids, grouting equipment, well screen, riser pipe, filter pack material and other materials that come in contact with the monitoring well environment which could possibly cause contamination. After the well construction material has been cleaned, it must not come in contact with the ground or any other source of contamination. Well construction personnel must take precautions to ensure grease, oil or other contaminants do not come in contact with the well screen and the riser pipe during construction. Personnel must wear appropriate apparel while constructing the well to protect them from contamination and from contaminating the monitoring well. A protective ground covering or other devices should be placed at the wellhead during construction activities to protect all materials from potential ground surface contamination.

(B) Nonhazardous Waste Sites. Precautions must be taken to ensure that monitoring well construction operations are carried out in such a way as not to harm the environment or adversely influence the operation of the monitoring well.

(7) Installation of Well Screen and Riser Assembly. The well screen and riser assembly must be centered in the borehole before the installation of the filter pack. The riser pipe must extend at least 1 foot above the finished grade in nonflood potential areas and at least 2 feet above the finished surface grade in flood prone areas and be equipped with a watertight cap. Wells installed in

traffic ways may be flush mounted, (see subsection (12)(B)). The use of centralizers on the riser assembly is required and must be placed just above the well screen and as needed up the hole to maintain the riser assembly in the center of the borehole. The type of centralizer used must not prevent emplacement of filter pack materials or annular seals. The use of centralizers in wells constructed through hollow stem augers or wells less than 50 feet in depth is not required.

(8) Installation of Primary Filter Pack. After the well screen and riser assembly are installed in the well, the filter pack materials can be emplaced. Proper design of monitoring wells drilled in unconsolidated to poorly consolidated geologic material must include an appropriately sized well screen and filter pack. It is recommended that screen slot size and filter pack size be determined by sieve analysis of formation materials to be monitored. The grain size and gradation of the filter pack are selected to stabilize the hydrologic unit adjacent to the screen and permit only the finest soil grains to enter the screen during development. The purpose of the filter pack is to prevent or minimize the entrance of fine material into the well and provide a representative water sample from the monitoring horizon. Sediment-free water reduces the potential for interference in sample analyses and is evidence that proper development of the well has occurred. The use of a fine screen and appropriately sized filter pack is permitted without sieve analysis.

(A) Artificially Constructed Filter Pack Placement. The filter pack material must be placed evenly around the well screen via a tremie pipe. The tremie pipe must be placed near the bottom of the well screen and the filter pack material poured into the tremie pipe while the pipe is slowly removed. A weighted measuring device must be used to ensure that the filter pack is properly installed to the desired depth. All volumes of filter pack material anticipated for construction must be calculated prior to placement. The filter pack material must fill from the bottom of the borehole within 2 feet to 5 feet above the well screen. If the borehole is not stable and the well is drilled utilizing the hollow stem auger method, the filter pack material may be poured through the hollow stem auger as it is removed from the borehole. This is allowed only in the unsaturated zone. If the screen is set more than 25 feet into the saturated zone or placed into drilling fluid other than clean water or air, the filter pack placement must be via tremie. Prepacked filter pack assemblies may be used.

(B) Naturally Developed Filter Pack Placement. Allowing the existing geologic material to collapse around the well screen is an acceptable method of filter pack emplacement in only a few geologic conditions. Naturally developed filter packs are only allowable when they can be developed properly. The higher permeability envelope of material is developed in place by the removal of the fine-grained material during proper well development process.

(C) In very shallow monitoring wells, the amount of filter pack material that extends above the well screen may need to be limited to ensure an adequate length of annular seal.

(9) Installation of Secondary Filter Pack. The purpose of a secondary filter pack, which is placed directly on top of the primary filter pack, is to ensure that annular seal slurry grouts do not infiltrate into the primary filter pack. The secondary filter pack must extend from 1 foot to 2 feet above the primary filter pack and shall consist of 1 foot to 2 feet of clean fine sand. A secondary filter pack is not required if the bentonite seal is composed of nonslurry bentonite.

(10) Installation of the Bentonite Seal. The bentonite seal is emplaced directly over the secondary filter pack or primary filter pack if a secondary filter is not necessary and must be from 3 feet to 5 feet thick. The purpose of the bentonite seal is to keep the slurry grout which is emplaced above from mixing with the primary and secondary filter pack materials.

(A) Placement of the Bentonite Seal in the Saturated Zone. When the bentonite seal is to be emplaced in the saturated zone, only chipped or pelletized bentonite that is designed to fall through standing water before it hydrates may be used. To avoid flash swelling and bridging, the fine bentonite material which may develop during transport must not be introduced into the well bore. One way to accomplish this is to pour bentonite over a screen so that the fine bentonite material, which may develop on transport of the product, is filtered out of the bentonite. A weighted measuring device must be utilized to ensure the bentonite chips are evenly placed around the riser pipe. All volumes of bentonite must be calculated prior to construction.

(B) Placement of the Bentonite Seal in the Unsaturated Zone. When the top of the secondary filter pack is in the unsaturated zone,

the use of chipped, pelletized or granular bentonite is permitted only if the bentonite is emplaced in 1 foot layers that are hydrated in place with potable water before the succeeding layers are emplaced. Bentonite slurry may be used and must fill the annular space from the top of the secondary filter pack to the surface seal. The bentonite slurry must be emplaced through a tremie pipe with a side discharge so as to limit disruption of the filter packs.

(11) Installation of the Annular Seal. The monitoring well environment may contain many chemicals or organic compounds that could affect the sealing capabilities of various kinds of grout. The type of grout used must be able to function to 100 percent of its designed sealing capabilities until the well is properly plugged. The type of grout used must not influence, contaminate or hinder the use of the monitoring well for its designed purpose. The annular seal must extend from the secondary filter pack or bentonite seal to the base of the protective casing. The following four (4) grout types are permitted in monitoring wells:

(A) Bentonite Slurry-Grout. High solids sodium bentonite slurry, at least 20 to 30 percent by weight solids, must be tremie grouted from the bottom to the top of the annular space in one continual operation. This grout is recommended for use in most monitoring well situations. Additives may be used to increase or decrease set times for the slurry, with prior approval from the division. Polymer additives may not be used in construction of monitoring wells when investigation may involve hazardous constituents;

(B) Nonslurry Bentonite. Sodium bentonite comes in many shapes and sizes. Nonslurry bentonite includes chips, pellets, granules and powdered varieties. Chipped or pelletized varieties that are designed to fall through standing water may be used when sealing the annulus of a well that is below the saturated zone. Granulated and powdered bentonite must never be poured through standing water because they will flash swell and bridge off before it gets to the bottom of the annular space. Bentonite chips or pellets may be used to seal portions of the annular space that are in the unsaturated zone. Granulated and powdered varieties are not permitted to be used in the unsaturated zone unless they are used to create a slurry, due to their flash swelling properties which would prevent hydration of the complete column of

bentonite. The effective use of bentonite chips or pellets as a sealing agent depends on the efficient hydration of the bentonite following emplacement. Therefore, when using bentonite chips or pellets in the unsaturated zone, they must be hydrated after each 3 feet interval has been emplaced. To properly hydrate the bentonite, a minimum of three times as much water as bentonite must be used. Quality of water is very important in the hydration process. Bentonite chips or pellets may not adequately hydrate if any of the following chemical parameters exist in the water used for hydration:

- 1) greater than 500 parts per million (ppm) total dissolved solids (TDS),
- 2) high chlorides,
- 3) large quantities of organic solvents or acids, and
- 4) separate-phase petroleum hydrocarbons;

(C) Cement-Slurry. Neat cement slurry is a mixture of one 94 pound bag of Portland Type I cement and six gallons of clean water and is the most commonly used cement product for sealing annular spaces. Five general types of cement are produced: Type I, for general use; Type II, for moderate sulfate resistance or moderate heat of hydration; Type III, for hi-early strength; Type ASDIV, for low heat of hydration; and Type V, for high sulfate resistance. Following are some problems associated with cement-slurry grout usage:

1. During the curing process of cement slurry, the chemical reactions that take place produce heat as a by-product. This heat of hydration can, in some cases, cause failures when riser pipe or casing is made of PVC or ABS materials. When neat cement slurry is used to fill annular spaces that are one and 1 1/2 to 4 inches, temperature increases from 16 degrees Fahrenheit to 45 degree Fahrenheit can be achieved. If there is a small washout of the annular space, that increases it to 12 inches and this space is filled with neat cement slurry, temperature increases up to 170 degrees Fahrenheit can be achieved. These extreme temperatures can cause riser pipe or casing failures (see 10CSR 23-3.070(3)(G) for table showing percent of strength loss for PVC casing with elevating temperatures);

2. Type II cement used to produce a hi-early strength and additives that are used to speed up set times of cement slurries cause higher than normal heat of hydration temperatures. These can only be used in association with metallic casings or riser pipes with prior approval by the division;

3. Another problem that occurs during the curing process of neat cement-slurry is that it shrinks from 12 percent to 17 percent. This shrinkage is not acceptable for monitoring well applications;

4. Cement-slurry may only be used if additives are incorporated to minimize shrinkage.

A. Bentonite is the most commonly used additive to prevent shrinkage of cement slurries. The powdered bentonite must be thoroughly mixed with the water before it is added to the cement. Powdered bentonite from two percent to six percent by weight must be added. The added bentonite improves the workability of the slurry, reduces shrinkage and reduces the heat of hydration. This additive does reduce the strength of the seal but is adequate for annular sealing; For each percent of bentonite by weight added to a 94 pound bag of Type I cement an additional six-tenths gallon of water must be added. The following table sets out the amount of bentonite and water needed to be a 94 pound bag of Type I cement to get from one to six percent cement-bentonite mixture.

B. Other shrinkage reducing additives must be approved in advance by the division;

5. The water used to mix cement slurry must be clean water, free of oil or other organic material and the total dissolved mineral content must be less than 2,000 ppm. If too much water is used, the grout will be weakened and excessive shrinkage will occur upon curing; and

CEMENT/BENTONITE SLURRY CALCULATIONS

Product	% bentonite added/sk cement	total water requirement gallons
Type I Portland 1 sack=94 lbs.	0	5.2 to 6
	1% bentonite = .94 lbs. bentonite/sk of cement	5.8 to 6.6
	2 % bentonite = 1.9 lbs. bentonite/sk of cement	6.4 to 7.2
	3% bentonite = 2.8 lbs. bentonite/sk of cement	7 to 7.8
	4% bentonite = 3.8 lbs. bentonite/sk of cement	7.6 to 8.4
	5% bentonite = 4.7 lbs. bentonite/sk of cement	8.2 to 9
	6% bentonite = 5.7 lbs. bentonite/sk of cement	8.8 to 9.6

6. Cement slurry must be emplaced in the annulus via a tremie pipe placed to the bottom of the annular space. The tremie pipe must have a side discharge which directs the grout away from the bentonite seal, reducing the potential for infiltration. Care must be taken so as not to dislodge the bentonite seal that is above the primary filter pack. The grouting of the annular space must be completed in one continual operation, lifting the tremie pipe as the space fills. If determined necessary by the division, a staged grouting procedure will be approved;

(D) Other types of grout may be used when necessary and for good cause if prior approval by the division is granted; and

(E) When zones of high grout loss are anticipated or experienced, contact the division for alternative methods to seal the annulus.

(12) Well Protection. Surface protection on monitoring wells is needed to deter unauthorized entry, prevent surface water from entering the annular space and to protect the well from accidental damage caused by collision from vehicles or heavy equipment. The two types of protective casing designs are above ground completions and flush mount completions.

(A) Above Ground Completions. Above ground completions must meet the following standards:

1. The protective casing must extend at least 1 1/2 feet above the finished grade of the ground surface to a point at least 2 feet below the finished grade, except as stated in paragraph (12)(B) of this rule for flush mount completions. The riser pipe must be at least 2 inches below the top of the protective casing. The casing must be placed in an enlarged hole that is at least 8 inches in diameter larger than the protective casing size. Care must be taken so that the shape of this hole when filled with concrete or

cement-slurry does not encourage frost heaving. The protective casing must be centered in this hole and concrete poured around the casing to secure it. Cement or bentonite slurry is not to be used. All water must be removed from this enlarged hole before concrete may be added. The surface of the grout must slope away from the protective casing so that pooling of surface water does not occur;

2. A small diameter hole must be drilled into the protective casing near the ground level to drain any water that fills the protective casing annulus.

Installation of a small amount of gravel for filling the annular space above the drain hole or installing a screen on the drain hole should be sufficient to prevent insects from entering this area;

3. A locking well cap and a suitable lock must be attached to the top of the protective casing. The riser pipe must extend at least 2 feet above the finished surface grade in flood prone areas and be equipped with a watertight cap.

4. All monitoring wells that have a protective casing extending from the ground must have a marker to show location. This marker must be plainly visible so that it can be easily located and its presence will help to prevent accidental damage. In some situations, it may be required that additional protective devices be installed, such as metal concrete filled posts (bolsters) or fencing. This is to prevent damage or unauthorized entrance; and

5. All monitoring wells must be labeled so as to distinguish one well from another on the monitoring site.

(B) Flush Mount Well Completions.

Monitoring wells may be completed utilizing a flush mount . Flush mount completions must meet the following standards. In a flush-to-ground completion, the flush mount assembly is installed around the riser pipe that has been cut off below grade. The flush mount assembly must be at least 8 inches in length and have a lockable watertight cap. The assembly must be set into a hole that is at least 8 inches in diameter larger than the diameter of the flush mount assembly and set in concrete. This completion

must withstand all stresses due to traffic and to freeze thaw processes. If the monitoring well is being placed through asphalt or concrete, a hole that is at least 4 inches in diameter larger than the diameter of the flush mount assembly must be drilled. The flush mount must then be set in concrete. Cement or bentonite slurry is not permitted. In areas where significant amount of runoff occur, additional safeguards to manage drainage may be necessary to discourage entry of surface runoff. *

(13) Wells must be adequate in size, design and development for the intended use.

(14) Extraction wells must be constructed to standards determined on a case-by-case basis, by the division.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-4.070 Monitoring Well Development

PURPOSE: This rule describes the minimum standards that must be met in developing a monitoring well.

(1) Monitoring well development serves the function of cleaning up the well, setting the filter pack and allowing for the collection of a representative sample from the horizon being monitored. The purpose of development is to remove any fine grained material from the well screen and filter pack that may interfere with analyses and return the monitoring zone to its original hydraulic state, which was disturbed by the drilling of the well. Development will also redistribute the sand grains within the filter pack to allow for coarser sand material to congregate near the slotted screen and finer sand grains may be removed by development.

(2) Methods Used to Develop Wells. The method used must not introduce any contaminants into the well. Wells must be developed until water representative of the formation is discharged. The volume of fluid should be a multiplier (three times minimum) of the amount of fluid lost to the formation during drilling or added to the well during development. Mechanical surging in combination with pumping or bailing is a recommended method for well development. Water must be moved both in and out of the filter pack to rearrange the sand grains. If a well is completed in a silt or clay rich material or if the screen straddles the water table, the well discharge may never totally clear up. The purpose of the well development is to remove formation damage caused by the drilling process and produce water that is representative of the formation. The well should be capable of producing clear water samples using appropriate sample methods.

(3) The use and installation of sampling, development, maintenance, or testing devices and equipment in monitoring wells, including extraction wells, is not regulated except that pumping system installation in extraction wells used for remediation or clean-up must be performed by a nonrestricted pump installation contractor.

*Auth: sections 256.606, 256.626 and 256.637, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626 and 256.637, RSMo (1985), amended 1991.*

10 CSR 23-4.080 Plugging of Monitoring Wells

PURPOSE: This rule sets standards for the plugging of monitoring wells.

(1) A monitoring well that is abandoned as defined in 10 CSR 23-1.010 must be plugged immediately. If a monitoring well has been determined to present a threat to groundwater, the division may order that the well be permanently plugged. When plugging a monitoring well, the following minimum requirements shall be met:

(A) All pumps, sampling equipment, debris or other substances must be removed that would interfere with the proper plugging of the well;

(B) All protective casing, riser pipe and well screen must be removed from the borehole, if possible, unless approved by the division. Because the primary purpose of well plugging is to eliminate vertical fluid migration along the borehole, the preferred method of plugging involves casing and riser pipe removal. If, when removing the casing the borehole begins to collapse, grout must be simultaneously emplaced while the casing is removed to ensure a proper seal. In certain situations, the casing or riser pipe must be drilled out if it can not be removed before the well is plugged. These situations will be determined on a case-by-case basis by the division. When casing is not required to be removed or if after attempting to remove the casing, it is not possible to remove it, then a hole must be dug around the casing 3 feet deep and the casing and riser pipe cut off at that depth;

(C) The well must be filled from bottom to top with grout. 10 CSR 23-4.060 (11) sets standards for grout types that may be used when plugging monitoring wells; and

(D) If bentonite grout is used, after the grout is fully cured, check for settlement and top off if necessary. Fill with soil and compact the upper 2 feet of hole or pave. The purpose of the compacted soil is to ensure that dehydration of the bentonite grout does not occur over time. If cement-slurry grout is used, fill the upper 2 feet with soil or pave. Slight mounding over the well is recommended to prevent water from standing in the immediate area of the well.

(2) The plugging or complete excavation of all monitoring wells must be reported on a registration report form supplied by the division. These forms must be submitted, along with the fee, within 60 days of the plugging (see 10 CSR 23-2 for applicable fees). If the review of the registration report form shows that the well has been plugged according to the rules, a registration number will be issued and sent to the well owner. The registration number indicates that the well was plugged according to the standards set out in the rules. When field screening type of temporary wells are drilled, usually multiple installations per monitoring site are used. All temporary wells per monitoring site may be reported on one registration report form if they are all plugged the same way and only one registration fee is required per site.

(3) Monitoring wells must be plugged by a permitted monitoring well installation contractor.

(4) Material used to plug monitoring wells must be compatible with any contaminants in the well so that the plugging action of the grout is not destroyed by any chemical reactions that may take place in the borehole environment.

(5) Monitoring wells less than 10 feet in depth must be plugged by returning uncontaminated native material or grout into the hole it was taken from. No reporting is required for these wells.

(6) Temporary monitoring wells greater than ten feet (10') in depth must be plugged by removing any temporary pipe and filling the well from total depth to ten feet (10') from the surface with approved grout, with the remainder of the well filled with uncontaminated compacted native material or grout.

*Auth: sections 256.606, 256.615 and 256.623, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original ruled filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606 and 256.615, RSMo (1991) and 256.623, RSMo (1985), amended 1991.*

Chapter 5

Heat Pump Construction Code

Title 10 - DEPARTMENT OF NATURAL RESOURCES
Division 23 - Geology and Land Survey

Chapter 5 - Heat Pump Construction Code

10 CSR 23-5.010 Definitions

PURPOSE: This rule specifically defines words used in Chapter 5 concerning heat pump wells, otherwise the definitions contained in 10 CSR 23-1.010 apply.

(1) **Horizontal closed-loop heat pump well** means a trench or pit usually parallel to the horizon and more than 10 feet in depth into which a closed-loop pipe is placed for the purpose of heat transfer. Closed-loop heat pump systems installed in trenches or pits 10 feet or less in depth are exempt from these rules.

(2) **Open-loop heat pump water supply well** means a well drilled to supply water for the purpose of heat transfer. This type of well is to be constructed to domestic well standards, 10 CSR 23-3.010-10 CSR 23-3.100 if it produces less than 70 gallons per minute or to public water supply standards if it produces more than 70 gallons of water per minute.

(3) **Vertical closed-loop heat pump well** means the borehole perpendicular to the horizon deeper than 10 feet into which a closed-loop pipe is placed for the purpose of heat transfer.

(4) **Water return well** means a well constructed for the purpose of returning water that has passed through the heat pump machine to the same aquifer that it was produced from in the open-loop water supply well.

*Auth: sections 256.603, 256.606, 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996.*

**Original authority: 256.603, RSMo (1985), amended 1991; 256.606, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-5.020 Certification and Registration of Heat Pump Systems

PURPOSE: This rule sets required standards for certification report form submittal.

(1) A certification report form, supplied by the division, shall be used to report the construction of open-loop and closed-loop heat pump systems which utilize trenches pits and/or wells as loop installation points. One (1) certification report form per heat pump system shall be completed and submitted to the division by the permittee within 60 days after completion of the system. The certification report form shall be accompanied by the certification fee (see 10 CSR 23 - 2 for fees). The permittee shall furnish the well owner one copy, the division one copy and retain one copy in the permittee's files. The report form shall contain all required information. Heat pump systems that utilize trenches or bodies of water to house the closed-loop are required to submit one certification report form for the system. Heat pump systems that utilize wells are required to submit one certification report form.

(2) The certification process involves the review of the certification report form to be sure that the heat pump system meets all construction requirements necessary for the specific area the system has been constructed. The minimum construction standards were written to protect Missouri's groundwater and to help ensure that the construction of the system does not constitute a threat to this resource.

(3) Upon successful completion of the review of the certification report forms, a certification number, which indicates that the heat pump system has met the minimum standards set in these rules, will be sent to the landowner.

(4) The registration process involves the documentation of certain types of activities according to the requirements and reported on forms supplied by the division.

(5) A registration report form, supplied by the division, shall be used to report major repairs and alterations of heat pump systems and the plugging of heat pump systems and must be submitted to the division by the permittee within 60 days after completion of the appropriate operations.

The registration report form shall be accompanied by the registration fee. The permittee shall furnish the well owner one copy, the division one copy and retain one copy in the permittees files. The report form shall contain all required information.

*Auth. sections 256.606, 256.623 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996.*
**Original authority: 256.606, RSMo (1991); and 256.623 and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-5.030 General Protection of Groundwater Quality and Resources

PURPOSE: This rule prevents the use of heat pump wells for any other purpose.

- (1) Heat pump wells once constructed shall not be converted to any other type of well, except by written approval by the division.
- (2) It is the obligation and responsibility of the heat pump installation contractor to ensure that the heat pump system is constructed according to the rules. On systems that utilize wells, the heat pump installation contractor is responsible for the integrity of the annular seal for a period of time from the date of certification to three years after that unless it can be shown that the well seal has been damaged by other persons.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-5.040 Location of Heat Pump Wells

PURPOSE: This rule sets standards for the placement of heat pump wells.

(1) A vertical heat pump well shall be located on a site which has good surface drainage and prevents the accumulation of water within 10 feet of the well and any buried pipes.

(2) Vertical heat pump wells shall not be located within certain distances from pollution or contamination sources. A vertical heat pump well shall be at least

(A) Three hundred feet from a storage area for commercial fertilizers or chemicals, landfill, lagoon, above ground or underground storage tank for petroleum, petroleum products or chemicals.

(B) One hundred feet from a below-grade manure storage area, cesspool, unplugged abandoned well, subsurface disposal field (lateral field), grave, building or yard used for livestock or poultry, privy or other contaminants that may drain into the ground.

(C) Fifty feet from an existing operating well, a septic tank, buried sewer, a pit or unfilled space below ground surface, a sump, except that a well may be drilled closer than 50 feet to a basement or heat pump well.

(3) Horizontal heat pump wells should be at least 2 feet above or below any other intersecting underground piping (to prevent freezing of the water lines) or wiring on the property, except a soaker pipe for the heat pump system used to keep the soil moisture constant.

(4) A variance may be granted if set back distances cannot be met. The variance must be obtained in advance from the division.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expires April 10, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996.*

**Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-5.050 Construction Standards for Closed-Loop Heat Pump Wells

PURPOSE: This rule describes the minimum standards for a properly constructed closed-loop heat pump well.

(1) **Casing Material.** If permanent casing is needed in a heat pump well, it must meet standards set out in 10 CSR 23-3.030 for steel and 10 CSR 23-3.070 for plastic and must be grouted full-length.

(2) **Heat Pump Loop Material.** In a closed-loop heat pump well, the material used to make up the heat-exchange loop that is placed in the ground or into a body of water must be composed of high density polyethylene or polybutylene pipe and must be installed and grouted without delay upon completion of drilling of each well.

(A) High Density Polyethylene Pipe. This pipe must be manufactured in accordance with dimensional specifications of ASTM D-2513 or ASTM F-714 and must have a minimum cell classification of PE345434C or PE355434C when tested under ASTM D-3350 to be acceptable for use in closed-loop heat pump systems.

(B) Polybutylene Pipe. This pipe must be manufactured in accordance with ASTM D-2581. The pipe material must be-

1. Either Class B (general purpose and dielectric, in colors) or Class C (weather resistant, black in color containing not less than two percent carbon black);

2. Type II (density, ninety-one thousands to ninety-two thousands grams per centimeter (g/cm);

3. Grade 1. (flow rate twenty-five thousandths to seventy-five thousandths gallons per 10 minutes).

(3) **Connecting Closed-Loop Pipe.** Polyethylene and polybutylene pipe must be thermally fused according to the pipe manufacturer's specifications and must not leak after assembly.

(4) **Heat Transfer Fluid.** The fluid used inside the closed-loop assembly must be approved by the board and meet the following standards:

(A) Heat transfer fluids must be composed of

1. Pure glycerine solution-glycerine must be 96.5 percent United States pharmacopoeia grade;
2. Food grade propylene glycol;
3. Dipotassium phosphate;
4. Sodium chloride;
5. Potassium acetate;
6. Methanol;
7. Water;
8. Ethanol; or

9. Other fluids may be used if approval by the division is received in advance;

(B) The fluid as it is used in a diluted state in the closed-loop must have the following properties:

1. Be 90 percent biodegradable;
2. Demonstrate low corrosion to all materials common to ground source heat pump systems;
3. Be homogeneous, uniform in color, free from lumps, skins and foreign material that would be detrimental to fluid usage;
4. Not have a flash point lower than 90 degrees Celsius;
5. Not have a five-day biological oxygen demand (BOD) at 10 degrees Celsius that exceeds two-tenths gram oxygen per gram nor be less than one-tenth gram oxygen per gram;
6. Not have a toxicity that is less than lethal dose (LD) 50 oral-rats of five grams per kilogram; and

7. Show neither separation from exposure to heat or cold, nor show an increase in turbidity; and

(C) While this rule attempts to define antifreeze fluids that will protect the environment, it is the responsibility of the permittee to become familiar with safe and proper use of these fluids and to take necessary precautions to ensure groundwater protection.

(5) **Hole size.** The hole size for heat pump wells that are grouted full-length with high solids bentonite slurry (see 10 CSR 23-5.050(9)(A)) must be of sufficient size to allow placement of the pipe and placement of a tremie to emplace the high solids bentonite slurry. The slurry must fill the hole and surround all pipes. There must be at least 1/2 inch between the hole and all pipes. If full-length high solids bentonite slurry is not used, then the following hole sizes are required:

(A) At least a six-inch borehole when the loop pipe is 1 1/4 inch or greater in diameter;

(B) At least a 5 inch borehole when the loop pipe is less than 1 1/4 inches in diameter.

(6) **Hole Depth.** Closed-loop heat pump wells must not be deeper than 200 feet. A variance must be obtained in advance, from the division, to drill a heat pump well deeper than 200 feet. A heat pump well drilled in Area C (see 10 CSR 23-3.100 (3)) that is less than 200 feet deep and cuts the Northview Formation must have a 30 foot grout plug set starting at 10 feet below the bottom of the Northview Formation. A map will be provided by the division showing the depth the grout plug must start. Follow the grouting requirement set out in 10 CSR 23-5.050 (8) for grouting the interval above the Northview Formation. Total depth of a new heat pump well in Special Area 3 and Special Area 4 shall be determined in advance of drilling by the division. At any heat pump well being drilled, per division guidance, in which perchlorethylene (PCE) and/or trichloroethylene (TCE) is encountered in a pure-product phase, also known as Dense Non-Aqueous Phase Liquid (DNAPL), drilling shall cease and the division shall be notified immediately. The division will determine further action.

(7) **Heat Pump System Design.** The heat pump system that utilizes wells must be designed so that the grout used to seal the wells does not dehydrate because of excessive heat caused by an improperly designed heat pump system.

(8) Grouting Depth of Vertical Heat Pump Wells.

Grouting the annulus of a heat pump well is very important and must be completed immediately after the well is drilled due to cave-in potential in the uncased hole. Full-length grout is recommended and may be required (see section (5)) to prevent surface contamination from entering the drinking water aquifer through the borehole. The grout required for heat pump wells greater than 200 feet in depth must be determined by the division in advance. A variance from will be issued setting the grouting requirements. If the heat pump borehole is not grouted full-length, hole size requirements stated in section (5) must be followed and nonslurry bentonite plugs must be placed into the borehole. A plug (first plug) must be placed about forty feet (40') above the total depth of the borehole. This plug must be composed of bentonite chips or pellets utilizing at least one bag 40 feet above the total depth of the borehole. This plug must be composed of bentonite chips or pellets utilizing at least one bag of bentonite resulting in at least a 5 foot plug. Every 40 feet of borehole that exists above the first plug must have a plug set as described in this section. A near surface plug consisting of bentonite granules or powder must be set from a point 10 feet below the bottom of the trench, that connects the closed-loop to the heat pump machine, to the base of the trench. All bentonite plugs must be hydrated immediately after emplacement if they are in the unsaturated zone. All clean fill material placed between the bentonite plugs must be chlorinated. Heat pump wells in Special Area 3 and Special Area 4 must be grouted full length with thermal grout, placed from the bottom of the borehole up to ground surface.

(9) Approved Grout Materials. The following four grout types are permitted for use in heat pump wells:

(A) Bentonite Slurry. High solids sodium bentonite slurry must be at least 20 percent to 30 percent by weight solids to be used as grout. Thickened drilling mud or thinner bentonite slurry is strictly prohibited. Specialized pumps are required to pump a high solids bentonite slurry. When bentonite slurry is used, it must be applied in one continual motion, through a tremie lowered to the grouting point. It is recommended that full-length grout be used in all vertical closed-loop heat pump wells. The tremie pipe may be removed while the borehole is filled or removed afterward;

(B) Nonslurry Bentonite. Chipped or pelletized bentonite varieties that are designed to fall through standing water may only be used when sealing the annulus of a well that is below the water level in the saturated zone. Complete

hydration is difficult to achieve when using dry nonslurry bentonite in the unsaturated zone. All nonslurry sodium bentonite varieties may be used in the unsaturated zone if the hole is dry and no bridging occurs. The dry bentonite must be hydrated after emplacement. The effective use of nonslurry bentonite as a sealing agent depends on the efficient hydration of the product; and

(C) Thermal Grout Slurry. Grout containing at least seven and one-half percent by weight bentonite solids and no more than 65 percent by weight silica solids may be used as grout. The grout slurry mixture must exhibit a thermal conductivity greater than 0.85 Btu/hr. ft. degree F and permeability not more than 1×10^{-7} cm/s. Specialized pumps are required and the slurry mixture must be installed full-length through a tremie lowered to an initial grouting point within 20 feet of the base of the borehole; and

(D) Other Grout. Other types of grout may be used if approval is granted in advance by the division.

(10) Wells That Encounter Karst Conditions. When a borehole encounters caves or large fractures, grouting may become difficult. Small fractures are effectively sealed by using chipped bentonite. Clean fill (gravel, sand, and the like) may be used to fill these intervals. If the borehole cannot be grouted as specified, it must be plugged and a new location chosen. The heat pump loop can be redesigned for shorter boreholes not encountering these conditions.

(11) Jetted Heat Pump Wells. Closed-loop heat pump wells that are jetted in Area 5 (see Figure 5) must not be deeper than 75 feet and at least the upper 10 feet of borehole must be grouted.

(12) Heat Pump Wells in Special Area 3.

Portions of Franklin County within and south of the city of New Haven are listed as Special Area 3 (Figures 7B and 7C, 10 CSR 23-3.100(7)) due to the contamination of portions of the aquifer by one or more of the following chemicals of concern: tetrachloroethylene (PCE), trichloroethylene (TCE), PCE degradation products and TCE degradation products or other contaminants of the National Public Drinking Water Regulations (NPDWR). In this area it is necessary to utilize more stringent construction standards for new heat pump wells that are drilled into the aquifer. In Special Area 3 a qualified and properly trained individual shall collect all groundwater samples for analysis of chemical of concern.

(A) The division shall be consulted before constructing a new heat pump well in Special Area 3. The division will provide specific guidance on heat pump well drilling protocol and construction specifications on a case-by-case basis. The division must provide written approval for all new heat pump wells in Special Area 3 prior to construction.

(B) All drilling-derived fluid and solid materials shall be containerized and sampled before disposal in an appropriate location based on analytical results.

(C) At any heat pump well being drilled, per division guidance, in which PCE and/or TCE is encountered in a pure-product phase, (also known as Dense Non-Aqueous Phase Liquid or DNAPL), drilling shall cease and the division shall be notified immediately. The division will determine further action.

(13) Heat Pump Wells in Special Area 4.

Portions of St. Charles County west of the city of Weldon Spring are listed as Special Area 4 (Figures 7D, 10 CSR 23-3.100(8)) due to the contamination of portions of the aquifer by one (1) or more of the following chemicals of concern: trinitrotoluene (TNT) and dinitrotoluene (DNT) at the Army Corps of Engineers (COE) site, 2,4,6-TNT, 2,4,-DNT, 2,6-DNT, dinitrobenzene (1,3-DB), nitrobenzene (NB), nitrate, uranium, and trichloroethylene (TCE) at the Department of Energy (DOE) Main Site, uranium and 2,4-DNT at the DOE Quarry, or other contaminants of the National Public Drinking Water Regulations (NPDWR). In this area it is necessary to utilize more stringent construction standards for new heat pump wells that are drilled into or through the shallow aquifer defined as the Burlington Keokuk/Fern Glen formation(s) at the main site and the Kimmswick limestone at the DOE Quarry. In Special Area 4 a qualified and properly trained individual shall collect all groundwater samples for analysis of chemicals of concern. Sampling qualifications and training requirements will be determined in advance of sampling by the division and approval will be issued in written format.

(A) The division shall be consulted before constructing a new heat pump well in Special Area 4. The division will provide specific guidance on heat pump well drilling protocol and construction specifications on a case-by-case basis. The division must provide written approval for all new heat pump wells prior to construction.

*AUTHORITY: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. Amended: Filed Dec. 16, 2002, effective June 30, 2003. Amended: Filed April 7, 2003, effective June 30, 2003. Emergency rule filed March 21, 2005, effective April 1, 2005, expires Sept. 27, 2005. Amended: Filed Sept. 27, 2005, effective April 30, 2006. Amended: Filed: May 5, 2007, Effective: July 30, 2007. *Original authority: 256.606, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

**10 CSR 23-5.060 Construction Standards
for Open-Loop Heat Pump System That
Use Groundwater**

*PURPOSE: This rule sets standards for
open-loop heat pump systems that use wells to
produce or return groundwater.*

(1) Open-loop heat pump systems and their installers that utilize existing surface water supply which is plumbed through the heat pump machine and returned to the same surface water supply are exempt from these rules.

(2) Open-loop Heat Pump Systems and Groundwater Supply Wells. An open-loop heat pump uses groundwater produced from wells which are plumbed through the heat pump machine where the heat transfer of the groundwater is accomplished. The groundwater is then utilized at the surface or returned to the ground via a return well. Any new well utilized to supply water must meet the construction standards set out in 10 CSR 23-3. Any well that was constructed before October 1987, that is utilized as the water supply for an open-loop heat pump system is exempt from these rules, except that the surface disposal of the water may fall under the Division of Environmental Quality rules and the return of the produced water via a well must meet rules set out in this section.

(3) Surface Disposal of Used Water. After the water passes through the heat pump machine, it may be disposed of to the surface only if the water remains on the landowner's property. It may not be run to drainage that leaves the property unless applicable permits are secured through the Water Pollution Control Program, Division of Environmental Quality. If the heat pump utilizes more than 25 gallons of water per minute when it is in operation, surface disposal of the used water is prohibited.

(4) Water Return Wells for Domestic Heat Pump Applications. Water return wells meet the requirements set out in 10 CSR 23 Chapters 1,2 and 3 concerning casing, casing depth, well seal, borehole, grouting and reporting. The depth of the water return well must not exceed the depth of the water supply well. Water must be returned to the same aquifer it was taken from in the water supply well. A sanitary well seal or a pitless adapter may be used and the water return pipe must extend at least 20 feet below the static water table inside the well casing.

(5) Water Return Wells for Nondomestic Heat Pump Applications. Specifications for water return wells in other than domestic applications will be determined on a case-by-case basis by the division, taking into account the water quality and quantity, geology, hydrology and water usage in the area.

(6) To drill and construct an open-loop heat pump well or a water return well, the driller must have a nonrestricted water well installation permit.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996.
Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.

10 CSR 23-5.070 Construction Standards for Closed-Loop Heat Pump System that use Refrigerants as the Heat Transfer Fluid

PURPOSE: This rule sets standards for heat pump systems that use refrigerants in the closed-loop as the heat transfer fluid.

(1) Direct Expansion Heat Pump Systems. These types of systems utilize a network of copper tubing or other material buried in a pit or trench. The refrigerant is circulated through the tubing allowing the heat transfer to take place. The ground coil must be installed by a method which prevents leakage of the refrigerant.

(2) Any heat transfer fluids used in a direct expansion heat pump system must be nontoxic and nonhazardous such as HCFC-22, or others that are approved in advance by the division.

(3) Heat pump systems utilizing refrigerants in their closed-loops may be placed into vertical wells if approval is received in advance from the division.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-5.080 Plugging of Heat Pump Wells

PURPOSE: This rule sets standards on the proper plugging of wells used in heat pump applications.

(1) Vertical Closed-Loop Heat Pump Wells. To plug a properly constructed vertical closed-loop heat pump well the following specifications must be met:

(A) Remove all heat transfer fluid from the closed-loop;

(B) Dig down to the top of borehole and cut off the loop pipe. This must be at least 3 feet below the surface. Pump the remaining loop full of bentonite or cement slurry. Allow the grout to fill the upper 1 foot of borehole. Fill remaining hole with compacted earth or pavement; and

(C) Submit registration report form and fee to division within 60 days which documents the proper plugging of the heat pump well. Upon review and approval of the registration report form, a registration number will be sent to the landowner which designates that the well was plugged according to the minimum standards.

(2) Open-Loop Heat Pump Wells. Wells used to supply water for the heat pump and water return wells must be plugged as set out in 10 CSR 23-3.110.

Plugging of Wells and a registration report form submitted as if it were a water supply well.

(3) Plugging Improperly Constructed Heat Pump Wells. When it is determined by the division that a heat pump well is constructed improperly, it must be brought into compliance with the rules or plugged. To plug an improperly constructed heat pump well, the following specifications must be met:

(A) Remove all pipes from hole;

(B) Clean out well bore of loose material;

(C) Plug well full-length with approved grout; and

(D) Submit registration report form and fee.

*Auth: sections 256.606, 256.623 and 256.626, RSMo (Cum. Supp. 1991). * Emergency rule filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Original rule filed Aug. 17, 1993, effective March 10, 1994. Original authority: 256.606, RSMo (1991), and 256.623 and 256.626, RSMo (1985), amended 1991.*

Chapter 6

Test Hole Construction and Plugging Code

TITLE 10 - DEPARTMENT OF NATURAL RESOURCES
Division 23 - Geology and Land Survey

Chapter 6 - Test Hole Construction and Plugging Code

10 CSR 23-6.010 Definitions

PURPOSE: This rule specifically defines words used in Chapter 6 concerning test wells, otherwise the definitions contained in 10 CSR 23-1.010 apply.

Test hole means a hole drilled in the explorations for minerals or for geologic data. This includes, but is not limited to, stratigraphic holes drilled to obtain geologic information for structural studies, seismic shot holes and industrial mineral exploration holes.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994.
Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.

10 CSR 23-6.020 General Protection of Groundwater Quality and Resources

PURPOSE: This rule protects the overall groundwater quality and resources in Missouri.

(1) Differences Between Wells. The rules contained in 10 CSR 23-6 cover test holes drilled for obtaining geologic data or mineral exploration data. Test holes differ from water wells, monitoring wells and heat pump wells in that the information obtained from test holes and their locations are often proprietary information. Test holes, in many cases, are smaller in diameter than water wells.

In addition, test holes are drilled and are then quickly plugged.

(2) Test holes that are to be converted into other types of wells. Test holes may be converted into a well at the request of the landowner. All requests must be made in writing to the division, by the landowner. The well must meet the applicable standards contained in 10 CSR 23-1 - 10 CSR 23-6.

*Auth: sections 256.606, 256.615 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994.
Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-6.030 Location of Test Holes

PURPOSE: This rule sets criteria for the location of test holes.

The need to obtain site-specific data dictates the location of test holes. If the hole needs to be located closer than distance requirements stated in 10 CSR 23-3.010, a variance must be obtained before the hole is drilled (see 10 CSR 23-1.040 for details on variance issuance).

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-6.040 Construction Standards for Test Holes

PURPOSE: This rule describes the minimum standards for a properly constructed test hole.

- (1) Standards for Construction of Test Holes. All test holes shall be constructed in a manner that will conserve and protect the groundwater resources and not be a source or channel of contamination or pollution to any aquifer.
- (2) Casing Material. All casing used in the construction of a test well must meet or exceed standards set out in 10 CSR 23-3.030.
- (3) Casing Depth. If permanent surface casing is set, it must be set at least 50 feet into bedrock. Temporary surface casing lengths may be determined by the permitted contractor.
- (4) Temporary Cap. All holes must be capped during the period they remain unplugged.
- (5) Hole Size. Test hole size will be determined by the person owning the mineral rights or designing the hole.
- (6) Approved Grout. When a hole is grouted, procedures and materials set out in 10 CSR 23-3.030 (3) and (4) must be followed.

*Auth: sections 256.606 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991) and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-6.050 Plugging of Test Holes

PURPOSE: This rule establishes criteria for the proper procedures to be followed when plugging a test hole.

(1) All test holes, except those that are converted to other types of wells are to be plugged in accordance with this chapter within 60 days from the date that the well was drilled. Extensions of this time limit are available on a case by case basis from the division.

(A) Plugging the Test Hole.

1. Test holes with no surface casing.

A. Test holes must be filled with grout via tremie to within 2 feet of the ground surface. If the Davis Formation is penetrated, an expanding packer must be placed in the bottom portion of the formation and grouted to within 2 feet of the surface.

B. The top 2 feet of hole must be filled with soil.

C. A registration report form must be submitted to the division which documents the method of plugging the test hole.

2. Test holes with removable surface casing pipe.

A. If the Davis Formation is penetrated, an expanding packer must be set in the bottom portion of the formation.

B. The hole must be filled with grout from the packer to the bottom of the interior casing pipe via tremie pipe. This grout plug must extend from near the bottom of the Davis Formation to at least 50 feet above the top of the Davis Formation.

C. The hole must be backfilled with chlorinated clean fill such as varied sized agricultural lime, gravel or sand to the base of the surface casing pipe, while the interior casing is being pulled.

D. A 50 foot grout plug must be pumped through the surface casing pipe as it is being removed, filling the hole to the top of bedrock.

E. Chlorinated clean fill must be used to backfill the hole above the upper plug while the surface casing pipe is being removed. The clean fill must extend from the top of the grout plug to within 2 feet of the surface.

F. The top 2 feet of hole must be filled with on-site soil.

G. A registration report form must be submitted to the division which documents the method of plugging.

H. The test hole may be filled from total depth to surface with grout.

3. Test holes with grouted nonremovable surface casing.

A. Cut off casing 3 feet below ground surface making a hole at least 2 feet in diameter larger than the surface casing.

B. Fill the hole from total depth to within 2 feet of the surface with grout.

C. Fill remaining hole with soil.

D. Submit a registration report form to the division.

(2) Test Holes Drilled to Expand Quarrying and Surface Mining Operations. When test holes are drilled in the process of expanding quarrying and surface mining operations and are destroyed within one (1) year by the advance of the mine or quarry, they are required to be plugged by only inserting a temporary surface plug into the hole which will prevent surface water from entering the hole.

Reporting requirements are not required for these temporary wells. If these test holes are drilled deeper than the quarry or mine floor, they must be plugged from the mine floor to the total depth of the hole with approved grout. If these holes are not destroyed by the mining process within one year then the requirements of subsection (1)(A) must be met. Extensions of this time limit will be considered on a case-by-case basis by the division.

(3) Test Holes Drilled in Association with Clay Mining Operations, Shallow Industrial Minerals Exploration and Miscellaneous Geologic Data Holes.

(A) When the test hole is drilled that bottoms in an impermeable fire clay deposit, a temporary surface plug must be inserted which prevents surface water from entering the hole. The type of well is exempted from reporting requirements.

(B) When a test hole is drilled that bottoms at the bedrock-unconsolidated material contact or above, it must be plugged when no longer needed for exploratory purposes. If the test hole is less than 100 feet in depth and does not encounter a potable water horizon, the test hole must be plugged by filling the hole from bottom to top with the type of uncontaminated material removed from the hole or other approved grout. A registration report is required per site for holes drilled and plugged that are greater than 20 feet in depth. One registration fee is required per report form for this type of hole. If a test hole is less than 20 feet in depth, it must be filled with the material removed from the hole as soon as it is no longer needed for exploratory purposes. Test holes less than 20 feet in depth are exempted from the rules. These wells cannot be used in any way relative to monitoring well sites.

(C) If a test hole is greater than 100 feet in depth, it must be plugged as stated in 10CSR23-6.050(1).

*Auth: section 256.606, 256.614, 256.615 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed July 13, 1994, effective Jan. 29, 1995. Amended: Filed Nov. 1, 1995, effective June 30, 1996. *Original authority: 256.606, RSMo (1991); 256.614, RSMo (1985), amended 1991; 256.615, RSMo (1991); and 256.626, RSMo (1985), amended 1991.*

10 CSR 23-6.060 Confidentiality of Registration Report Form

PURPOSE: This rule sets standards to ensure that registration report forms are held confidential for at least ten years as required in section 256.615, RSMo.

(1) Confidentiality of Registration Report Forms. All registration report forms submitted to the division which document the plugging of holes drilled in the exploration for minerals or for geologic data must be held strictly confidential for a period of 10 years from the date of submittal. These holes include exploration drill holes for economic and industrial minerals and geologic data but do not include monitoring wells. The person submitting the report or the person for whom the well was drilled may request, in writing, that this information remain confidential for an additional five years and the division shall grant such request. The submittal of this type of registration report form and fee is required within 180 days of completion of the plugging of the test hole. Upon successful review of the registration report form, which indicated that the hole was plugged according to the rules, a registration number will be sent to the property owner which documents that the hole is plugged according to minimum standards.

(2) Since test holes are usually temporary in nature and are required to be plugged quickly after drilling, they are exempted from the certification process.

*Auth: sections 256.606, 256.614, 256.615 and 256.626, RSMo (Cum. Supp. 1991). * Original rule filed Aug. 17, 1993, effective March 10, 1994. *Original authority: 256.606, RSMo (1991); 256.614, RSMo (1985), amended 1991; 256.615, RSMo (1991); and 256.266, RSMo (1985), amended 1991.*

Appendix

" The Water Well Drillers Act" Sections 256.600 to 256.640 RSMo

GEOLOGY, WATER RESOURCES AND GEODETIC SURVEY

WATER WELL DRILLERS REGULATION

256.600. Title of Law.—Sections 256.600 to 256.640 shall be known and may be cited as “*The Water Well Drillers’ Act*”. (L. 1985 S.B. 281 1)

256.603. Definitions.—As used in sections 256.600 to 256.640, the following terms mean:

- (1) “**Abandoned well**”, a well shall be deemed abandoned which is in such a state of disrepair that continued use for the purpose of thermal recovery or obtaining groundwater is impractical and which has not been in use for a period of two years or more. The term “abandoned well” includes a test hole or a monitoring well which was drilled in exploration for minerals, or for geological, water quality or hydrologic data from the time that it is no longer used for exploratory purposes and that has not been plugged in accordance with rules and regulations pursuant to sections 256.600 to 256.640;
- (2) “**Board**”, the body created in section 256.605;
- (3) “**Certification report**”, a form to be sent to the division upon completion of any well which shows the location, static water level, total depth, initial pumpage, hole size, casing size and length, and name of well owner;
- (4) “**Division**”, the division of geology and land survey;
- (5) “**Driller’s log**”, a record accurately kept at the time of drilling showing the depth, thickness, character of the different strata penetrated, location of water-bearing strata, depth, size and character of casing installed, together with any other data or information required on the certification report forms;
- (6) “**Examination**”, an assessment of professional competency administered to applicants;
- (7) “**Heat pump installation contractor**”, any person, including owner, operator or drilling supervisor who engages for compensation in the drilling, boring, coring, or construction of any well in the state for extracting thermal energy;
- (8) “**Monitoring well installation contractor**”, any person, including owner, operator, or drilling supervisor who engages for compensation in the drilling, boring, coring, or construction of any well in this state which is drilled for geologic data, water quality, or hydrologic data;
- (9) “**Permitted well driller**”, any person who holds a permit issued pursuant to the provisions of sections 256.600 to 256.640;
- (10) “**Person**”, any individual, whether or not connected with a firm, partnership, association, corporation, or any other group or combination acting as a unit;
- (11) “**Pump installation contractor**”, any person, firm or corporation engaged in the business of installing or repairing pumps and pumping equipment;
- (12) “**Registration report**”, a form to be sent to the division upon completion of plugging of an abandoned well, raising casings, lining wells, deepening of wells, major repairs and alterations, and jetted wells;
- (13) “**Well**”, an excavation that is drilled, cored, bored, washed, driven, dug, jetted, trenched, or otherwise constructed when the intended use of such excavation is for the acquisition of groundwater supply, for monitoring, thermal exchange or for exploration for minerals or geologic or hydrologic data; but such term does not include a cistern, an excavation made for the purpose of obtaining or for prospecting for oil or natural gas, or for construction foundation data, dewatering of construction sites or dewatering of existing structures, observation wells used as a part of an underground storage tank leak detection system of a minimal depth, as determined by the board by rule, or for inserting media to repressure oil or natural-gas-bearing formations;
- (14) “**Well installation contractor**”, any person, including owner, operator, and drilling supervisor who engages for compensation in the drilling, boring, coring, or construction of any well in this state. The term, however, shall not include any person who drills, bores, cores, or constructs a water well on his own property for his own use or a person who assists in the construction of a water well under the direct supervision of a permitted well installation contractor and is not primarily responsible for drilling operations;
- (15) “**Well owner**”, any person or corporation who is the party responsible for having a well drilled and whose name appears on the well registration or certification form.
(L. 1985 S.B. 281 2, A.L. 1991 S.B. 221)

256.605. Well installation board established-membership-terms-qualifications.

1. The "Well Installation Board" is hereby established which shall be composed of nine members. Appointment to the board shall be made without regard to race, creed, sex, religion, or national origin of the appointees. Each member shall be a resident of the state and be conversant in well drilling, completion, and plugging methods and techniques.

2. Four members of the board shall hold valid permits under sections 256.600 to 256.640. Two of these shall hold permits as well installation contractors, one shall hold a permit as a heat pump installation contractor and as a well installation contractor and one shall hold a permit as a monitoring well installation contractor. Four shall be public members; one of these shall be a public water supply district user and one of these shall be a private well user. The director of the department or his designee shall serve as a member of the board. Board members shall serve four-year terms except that two of the first appointed public members and two of the first appointed members holding valid permits shall be appointed to two-year terms. Members shall be appointed by the governor with the advice and consent of the senate and each shall serve until his successor is duly appointed and qualified. Vacancies shall be filled by appointment for the unexpired term. Any member who fails to attend at least seventy-five percent of the regular board meetings in any one year, at the discretion of the board, shall be deemed to have resigned. Members shall be reimbursed for actual and necessary expenses incurred in the performance of their official duties while in attendance at board meetings or of appropriations made for that purpose.

3. A member shall not be employed by or own an interest in a company, firm, or business association which employs another member of the board or in which another member owns an interest, if the company, firm, or business association is engaged in any phase of the well drilling, pump installation, heat pump or monitoring well business.

4. Except for industry members, no member shall receive, or shall have received during the previous two years, income derived directly or indirectly from any permittee or applicant under sections 256.600 to 256.640.

5. The board shall meet on a quarterly basis, and special meetings may be called when deemed necessary by the division. A majority of the board is a quorum for conducting business. The board shall elect a chairman by a majority vote at the first meeting each year. (L. 1991 S.B. 221)

256.606. Rules and regulations-applicants' qualifications.

1. The board shall adopt and amend rules and regulations pursuant to chapter 536, RSMo, which may be reasonably necessary to govern the regulation of the well, the heat pump, monitoring well, and pump installation industry in the state of Missouri.

2. The division with the approval of the board shall prepare examinations and pass upon qualifications of the applicants for permits. The division with the approval of the board may recognize, prepare, or carry out continuing education programs for permittees. (L. 1991 S.B. 221)

256.607. Well installation contractor, permit-heat pump installation contractor, permit.

1. No person may engage in business in this state as a well installation contractor unless he has obtained from the division a permit to conduct such business or businesses.

2. Nothing in sections 256.600 to 256.640 shall prevent a person who has not obtained a permit pursuant to sections 256.600 to 256.640 from constructing a well on his own or leased property intended for use only in a single-family house which is his permanent residence, or intended for use only for farming purposes on his farm, and where the waters to be produced are not intended for use by the public or in any residence other than his own. Such person shall comply with all rules and regulations as to construction of wells adopted under sections 256.600 to 256.640.

3. Any well installation contractor or pump installation contractor acting as primary contractor in the construction, alteration, major repair or abandonment of any well shall be required to obtain a permit from the division and comply with all rules and regulations promulgated pursuant to sections 256.600 to 256.640.

4. Any heat pump installation contractor or monitoring well installation contractor shall obtain a permit from the division and comply with all rules and regulations pursuant to sections 256.600 to 256.640. (L. 1985 S.B. 281 3, A.L. 1991 S.B. 221)

256.611. Application, qualifications.-The division shall issue a permit as a well installation contractor, heat pump installation contractor, monitoring well contractor or pump installation contractor to any person properly making application therefor, who is not less than 18 years of age, has a knowledge of rules and regulations adopted under sections 256.600 to 256.640, and has passed the

appropriate examination and has supplied proof of adequate experience as specified by rule and regulation (L. 1985 S.B. 281 4, A.L. 1991 S.B. 221)

256.613. Written examinations.-Written examinations shall be designed to test the applicants' knowledge of the principles of well drilling and plugging, the methods of installation of pumping equipment and the rules and regulations promulgated under sections 256.600 to 256.640. (L. 1991 S.B. 221)

256.614. Notice to division, when-forms-registration and certification, fee-encountering gas or oil.

1. The division shall be notified, on certification or registration forms to be provided by the division, of the activities specified in this section within 60 days:

- (1) Certification forms shall be used to report:
 - (a) New well construction;
 - (b) New pump installations;
 - (c) Drilling of monitoring wells;
 - (d) Drilling of heat pump wells;
- (2) Registration forms shall be used to report:
 - (a) Plugging of wells;
 - (b) Raising of casing;
 - (c) Lining of wells;
 - (d) Deepening of wells;
 - (e) Major repairs and alteration to wells;
 - (f) Jetted well construction;
- (3) The certification form shall be accompanied by the certification fee and the registration form shall be accompanied by the registration fee; however, on new well construction and new pump installation, only one fee shall be required.

2. Any well driller who encounters oil or gas during drilling operations or a well owner who converts a well from a water well to an oil or gas well shall notify the division and file for a permit from the Missouri oil and gas council, and the well shall be completed in accordance with the regulations of the council. (L. 1985 S.B. 281 5, A.L. 1991 S.B. 221)

256.615. Abandoned wells, plugging required-test holes, plugging-confidentiality of information-penalty.

1. Wells abandoned by the landowner after August 28, 1991, shall be plugged or caused to be plugged by the landowner according to the regulations developed pursuant to sections 256.600 to 256.640. If the department makes a finding that certain unusual conditions exist at a well, the department may require that the same be plugged by a permitted well driller.

2. Any test hole which is drilled for underground exploration shall be plugged in accordance with rules and regulations developed pursuant to sections 256.600 to 256.640.

3. Any information obtained by the department which identifies a test hole or a monitoring well which was drilled in the exploration for minerals shall remain confidential and shall not be released by the division for a period of ten years following the receipt of the information which initially identified the test hole or monitoring well. The person submitting the report or the person for whom the well was drilled may request that such information remain confidential for an additional five years and the division shall grant such request. Any employee of the division who discloses confidential information shall be subject to disciplinary action by the division and is guilty of a class A misdemeanor. (L. 1991 S.B. 221)

256.616. Performance bond or letter of credit may be required-conditions.-A well installation contractor or pump installation contractor who has had a permit revoked or a person found guilty of a class A misdemeanor in accordance with section 256.637 shall provide to the division a performance bond or letter of credit in order to obtain a permit.

(1) The bond or letter of credit required by this section shall be:

(a) Conditioned upon faithful compliance with the conditions and terms of sections 256.600 to 256.640; and

(b) In such amount as determined by the division to ensure compliance with the procedures, rules and regulations, and standards established pursuant to sections 256.600 to 256.640, but shall not exceed ten thousand dollars or be less than one thousand dollars. When setting the amount, the division shall consider the total number of wells drilled or pumps installed and the average cost of each well drilled or serviced by the applicant;

(2) Such performance bond, placed on file with the director, shall be in one of the following forms:

(a) A performance bond, payable to the director and issued by an institution authorized to issue such bonds in this state; or

(b) An irrevocable letter of credit issued in favor of and payable to the director from a commercial bank or savings and loan having offices in the state of Missouri;

(3) The requirement for a performance bond or a letter of credit by a well installation contractor or pump installation contractor who has had a permit revoked, or a person who has been found guilty of a class A misdemeanor in accordance with section 256.637 shall cease after two consecutive years of well drilling or pump installation in accordance with the provisions of sections 256.600 to 256.640, and any rules or regulations promulgated pursuant to sections 256.600 to 256.640;

(4) Upon a determination by the division that a well contractor or pump installation contractor has failed to meet standards as set out in sections 256.600 to 256.640 and the rules and regulations promulgated thereunder, the division shall notify the well installation contractor or pump installation contractor that the bond or letter of credit will be forfeited and the moneys placed in the water well drillers fund for remedial action, if that person does not bring the well or borehole up to the standards established pursuant to sections 256.600 to 256.640 within sixty days after notification of such determination has been given;

(5) If a well is not brought up to the standards established pursuant to sections 256.600 to 256.640 within the sixty-day notification period the division may, upon expiration of the notification period, expend whatever portion of the bond or letter of credit is necessary to hire another contractor to bring the well or borehole up to standards or to construct a new well. (L. 1991 S.B. 221)

256.617. Drilling rigs, how marked-rig permits.-All permitted water well drillers shall see that all rigs used by them or their employees in the water well drilling are marked with legible identification numbers at all times.

The identification number to be used on the rigs shall be the permit license number which appears on the driller's permit. The rules and regulations adopted by the division shall set out in detail the specific method and manner for marking the rigs. A separate permit shall be obtained for each rig operated by a permitted water well driller during permit year. (L. 1985 S.B. 281 6)

256.620. Certain wells exempted from regulation.-Except as provided in section 256.615 operational wells in existence on September 28, 1985, shall not be required to conform to the provisions of sections 256.600 to 256.640, or any rules or regulations adopted pursuant thereto unless such wells or pump installations for such wells are determined to present a threat to groundwater. (L. 1985 S.B. 281 7, A.L. 1991 S.B. 221)

256.621. Surface water tracing, registration required-renewal-documentation required.-All persons engaged in groundwater or surface water tracing, for any purpose, shall register with the division. This registration shall be renewed annually. The registrant shall report in writing all proposed injections of tracers to the division prior to actual injection. Written and graphical documentation of traces shall be provided to the division within thirty days of completion of each trace. The division shall maintain records of all injections and traces reported and will provide this information to interested parties upon request at the cost of reproduction. (L. 1991 S.B. 221)

256.623. Fees-appeals process for disciplinary action.

1. The board shall by rules and regulations establish reasonable and necessary fees for:

- (1) Permits;
- (2) Renewal of permits;
- (3) Duplicate permits;
- (4) Rig permits;
- (5) Certification reports;
- (6) Registration reports;
- (7) Division publications (not to exceed the cost of publication and handling);
- (8) Logging of wells;
- (9) Examinations; and
- (10) Late document submittals.

2. The fees shall be set at a level necessary to produce revenue which shall not substantially exceed the cost and expense of administering sections 256.600 to 256.640. The board shall also by rules and regulations set forth

appeal processes for contractors subject to disciplinary action and shall set forth procedures by which any aggrieved party may bring a complaint to the division. (L. 1985 S.B. 281 8, A.L. 1991 S.B. 221)

256.626. Promulgation of rules and regulations-heat pump coolants, preference.

1. The board shall adopt, amend, and promulgate in the manner provided by law, and enforce rules and regulations pertaining to the construction and abandonment of wells, and the permitting of operators and contractors under sections 256.600 to 256.640.

2. The board shall specify by rule and regulation the types of materials which may be used as a coolant in a heat pump well. Preference shall be given to those coolants which would present the least threat to ground-water if released into the environment. The board shall also specify by rule and regulation those coolants which shall not be used in heat pump wells due to their potentially harmful effects if released into the environment.

(L. 1985 S.B. 281 A.L. 1991 S.B. 221)

256.628. Obligation to plug abandoned well, notification-information to be filed, form-inspection, injunction, penalty.

1. A public water supplier subject to the provisions of chapter 640, RSMo, which connects to any structure or location previously served by any well which is not that of another public water supplier shall notify the well owner of his obligation to plug any abandoned well pursuant to the requirements of sections 256.600 to 256.640. The public water supplier shall not connect any person to the public water system until the person submits information which identifies the location of wells and attests that:

- (1) Known abandoned wells on the property have been plugged; or
- (2) There are no known abandoned wells on the property; or
- (3) Existing wells will remain in use and will be properly plugged when no longer used; or
- (4) Any abandoned wells will be plugged within 90 days.

2. The public water supplier shall submit a copy of information so received to the division on forms provided by the division, along with sufficient information to enable the division to locate existing and

abandoned wells. The division shall, within a reasonable time, inspect any well identified in subdivision (4) of subsection 1 of this section. If the division determines that an abandoned well has not been plugged, it shall order the owner to have it plugged by a permitted water well installation contractor within thirty days. The division shall immediately seek injunctive relief through the office of the prosecuting attorney of the county wherein the alleged violation occurred to enforce its order and shall notify the appropriate public water Supplier who shall terminate water service to the property thirty days after receipt of notice if the well has not been plugged. Any person who fails to plug an abandoned well pursuant to the provisions of this subsection shall, upon conviction, be subject to penalties specified in section 256.637.

(L. 1991 S.B. 221)

256.630. Violations of law, suspension, revocation-procedure, appeals.

1. If the division determines that the holder of any permit issued pursuant to sections 256.600 to 256.640 has violated any provision of sections 256.600 to 256.640, or any rule or regulation adopted pursuant thereto, the division shall reprimand, suspend, place any such permittee on probation or revoke a permit.

2. The division shall cause to have issued and served upon the permittee a written notice of the order or revocation issued under section 256.619 or this section, which notice shall include a copy of the order, shall specify the provision of sections 256.600 to 256.640, or the standard, rule or regulation, order or permit term or condition of which the permittee is alleged to be in violation and a statement of the manner in which the person is alleged to violate sections 256.600 to 256.640, or the standard, rule or regulation, order or permit or condition. Service may be made upon any person within or without the state by registered or certified mail, return receipt requested. Any person against whom the division issues an order may appeal it by filing a petition with the board within 30 days. The appeal shall stay the enforcement of the order until a final determination is made.

3. After due consideration of the record, or upon default in appearance of the petitioner at any hearing of which he has been given notice by registered or certified mail, the board shall issue and enter such final order, or make such final determination as it deems appropriate under the circumstances. The board may sustain, reverse or modify the division's order or may make such other orders as it deems appropriate under the circumstances.

It shall notify the petitioner or respondent thereof in writing by certified or registered mail.

4. Any affected person aggrieved by an action of the division may appeal to the board. At any public hearing all testimony taken before the board, or a hearing officer appointed by the board, shall be under oath and recorded stenographically. The transcript so recorded shall be made available to any person upon payment of a fee equal to the cost of reproduction. All final orders and determinations of the board or the division made pursuant to the provisions of sections 256.600 to 256.640 are subject to judicial review pursuant to the provisions of section 536.100, RSMo. Any person who has exhausted all administrative remedies provided by chapter 536, RSMo, and who is aggrieved by a final decision in a contested case, whether such decision is form, shall be entitled to judicial review in the form of a trial de novo in the circuit court of the county wherein the alleged impropriety occurred.

(L. 1985 S.B. 281 10, A.L. 1991 S.B. 221)

256.633. Injunctions-attorney general to

represent division.-The division may petition a court of competent jurisdiction for injunctions or other appropriate relief to enforce the provisions of sections 256.600 to 256.640. The attorney general shall represent the division when requested to do so.

(L. 1985 S.B. 281 11)

256.635. Audit of division-groundwater protection fund, purpose.

1. The state auditor shall audit the financial transactions of the division in connection with the administration of sections 256.600 to 256.640.

2. All money collected by the division under the provisions of sections 256.600 to 256.640 shall be deposited in the state treasury to the credit of a special fund hereby established to be known as the "Groundwater Protection Fund." Moneys in the fund shall be expended only for the purposes of administering sections 256.600 to 256.640.

Notwithstanding the provisions of section 33.080, RSMo, any balance remaining in the fund at the end of an appropriation period shall not be transferred to general revenue, except that should there be a balance remaining in the fund at the end of an appropriation period exceeding one-half of the next year's projected operating budget for administration of sections 256.600 to 256.640, the amount exceeding one-half of the next year's projected budget shall be transferred to the general revenue fund.

(L. 1985 S.B. 281 12)

256.637. Violations of law, civil and criminal penalties.

1. Any person who willfully violates any of the provisions of sections 256.600 to 256.640 is guilty of a class A misdemeanor.

2. In the event of a continuing violation, each day that the violation continues shall constitute a separate and distinct offense.

3. Any person who willfully obstructs, hinders or prevents agents of the division in the performance of the duties imposed on them by sections 256.600 to 256.640 is guilty of a class A misdemeanor.

4. Any well owner who knowingly causes or permits a hazardous or potentially hazardous condition to exist which could cause deterioration of groundwater quality in the system, even in a local area, shall forfeit his right to an approved, certified well. He shall also be liable to legal action by the state and any neighboring well owners should the condition endanger the groundwater in surrounding areas. If the division finds that such conditions exist, it shall order the well owner to plug the well.

5. Upon receipt of a complaint filed with the division alleging that any provision of sections 256.600 to 256.640, or any standard, rule or regulation promulgated thereto was violated, the division may institute a civil action in the jurisdiction where the well is located for injunctive relief through the office of the prosecuting attorney of the county wherein the alleged violation occurred to prevent such violation or further violation, or for the assessment of a civil penalty not to exceed five hundred dollars per day for each day, or part thereof, the violation occurred and continued to occur, or both, as the court deems proper. For the purpose of this section, the filing of a well registration or certification form containing false information shall constitute a violation for each day after notification that such form is on file with the division. Any moneys paid in civil penalties shall be deposited in the groundwater protection fund. (L. 1985 S.B. 281 13, A.L. 1991 S.B. 221)

256.640. Rules, suspension by joint committee.-Any rule or portion of a rule promulgated and approved under any authority in sections 256.600 to 256.640 shall become effective until it has been approved by the joint committee on administrative rules. If the joint committee on administrative rules neither approves nor disapproves a rule within 30 days after the notice of proposed rulemaking has been published in the Missouri Register as soon as practicable, an order withdrawing the rule.

The provisions of sections 256.600 to 256.640 are nonservable and the grant of rulemaking authority is essentially dependent on the review power vested with the joint committee on administrative rules.

If the review power is held unconstitutional or invalid, the grant of rulemaking authority shall also be invalid or void.

(L. 1985 S.B. 281 14)



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